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ORIGINAL ARTICLES

CRITICAL REVIEW OF GOTTLIEB AND ORBAN'S "DIE VERÄNDERUNGEN DER GEWEBE BEI UEBERMAESSIGER BEANSPRUCHUNG DER ZÄHNE"

CHARLES F. BODECKER, D.D.S., F.A.C.D., NEW YORK, N. Y.
Professor of Oral Histology and Embryology, Columbia University Dental School

GOTTLIEB and Orban have made a valuable contribution to the dental literature in their book *Die Veränderungen der Gewebe bei Uebermaessiger Beanspruchung der Zähne.* It is to be hoped that an English translation will soon be available; it would prove invaluable to the scientifically thinking orthodontist and prosthodontist. (R. Kronfeld also collaborated in this work at first but could not finish his share because of his departure for Chicago.) The book contains 227 illustrations, and almost all of these are excellent photographs of microscopic specimens. The work was started in 1925. More than fifty dogs were used, but observations on only thirty-three are presented. The duration of the individual experiments varied from twelve hours to thirteen months. C. Brietner experimented with five monkeys; the observations on this material are also incorporated. While the deciduous teeth of the monkeys were usually present during these experiments, the authors' observations on the bone were made only as to the effects of the movement of the first permanent molar, in order not to confuse this picture with that of the resorbing roots of the deciduous teeth. Observations of human postmortem material are also included and discussed. The observed effects of the movement of animal teeth on the bone and peridental membrane are thus linked closely to those effects observed in man.

A critical review of this book can give the reader only an inkling of the rich contents. I have attempted to define the effects of tooth movement on the surrounding bone and peridental membrane and to condense this information into a series of diagrams. These can be grasped in a few minutes, and it is hoped that they will prove stimulating to a further study of this important

subject. These diagrams, based on observations of the book's many illustrations, were prepared in the following manner: a section of a normal human tooth with its surrounding alveolar process was taken and a camera lucida drawing made (Fig. 1). Imaginary pressure of varying degrees was exerted on the tooth, and the changes which would have resulted in the alveolus and the peridental membrane were depicted in successive diagrams. In these diagrams only those tissues which are of particular interest to the orthodontist have been shown, i. e., the surface of the tooth, the vessels of the peridental membrane, and the alveolar bone.

Fig. 1.—Camera lucida drawing of a mandibular second premolar (human) and the surrounding bone including the region of the first molar. In Figs. 2 to 6*D* the changes are shown in the peridental tissues of this tooth as a result of pressure in the direction of the arrow.

CHANGES IN THE PERIDENTAL MEMBRANE AS A RESULT OF PRESSURE

The function of the teeth has a direct bearing on the varying thickness of the peridental membrane. This may be classified, according to Gottlieb and Orban, as:

(a) Physiologic thickness.

(b) Biologic thickness.

(a) Physiologic thickness of the peridental membrane is present in teeth functioning under the normal stress of mastication. Generally speaking, the peridental membrane is thickest at the cervix and apex and thinnest at the

middle third of the teeth. (This applies more particularly to the anterior teeth which are subjected to a greater lateral stress.)

(b) Biologic thickness of the peridental membrane is present in those teeth which have no occlusion whatever, or in retained and impacted teeth, but in this condition the peridental membrane is thinner.

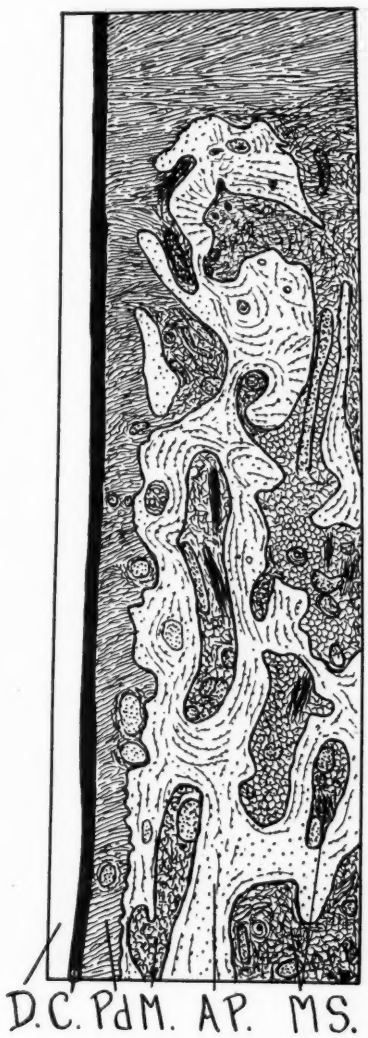


Fig. 2.—A drawing of the mesial alveolar crest of the premolar shown in Fig. 1. Note size of vessels in peridental membrane *(PdM)*; *D*, dentin; *C*, cementum; *AP*, alveolar process; *MS*, medullary spaces.

DESCRIPTION OF DIAGRAMS

Fig. 1 shows a camera lucida drawing of a mandibular second premolar of man and the surrounding bone, including that of the mandibular first molar. This tooth had been removed some time previous to the preparation of the sections, but the outline of the lamina dura which enclosed the two roots of the molar is still visible. New bone formation is particularly active in the depths of the alveoli.

A summary of the changes which take place in the peridental membrane

and the alveolar process noted in the book's many illustrations will be seen in the diagrams by supposing that the premolar depicted in Fig. 1 is moved in the direction of the arrow. This would cause a compression of the peridental membrane mesially in the cervical area, and distally in the apical portion of the membrane. Tension, on the other hand, would be brought to bear distally on the cervical area of the peridental membrane and on the apical portion of

A *B*

Fig. 3.—*A*, A diagram showing the result of pressure on the premolar in Fig. 1 from left to right. The heavy dotted line indicates the original position of the root as in Fig. 2. Note the changes in the vessels of the peridental membrane due to compression.

B, Effect of pressure on lamina dura. Original outline of alveolar process is shown by faintly dotted lines. Resorption is indicated by the red lines. Bone formation in the depths (indicated by green) to maintain normal thickness and strength of the lamina dura.

the root at the mesial surface. The supposed pressure to be exerted on this tooth will be of two intensities, both being in excess of the physiologic movement of the tooth. The first set of diagrams will show the changes resulting from a slight pressure, which causes no damage to the peridental tissues, and consequently appears best for the movement of teeth in orthodontic work; the second set will show the effects of extreme pressure.

CHANGES IN THE PERIDENTAL MEMBRANE AND BONE AS A RESULT OF SLIGHT PRESSURE ON A TOOTH

Fig. 2 shows a portion of the mesial alveolar crest of the specimen reproduced in Fig. 1. In this diagram the surface of the tooth is shown with its dentin (*D*) and cementum (*C*). Outside of this is the peridental membrane (*PdM*), with its profuse blood supply, and the white connective tissue fibers at-

C *D*

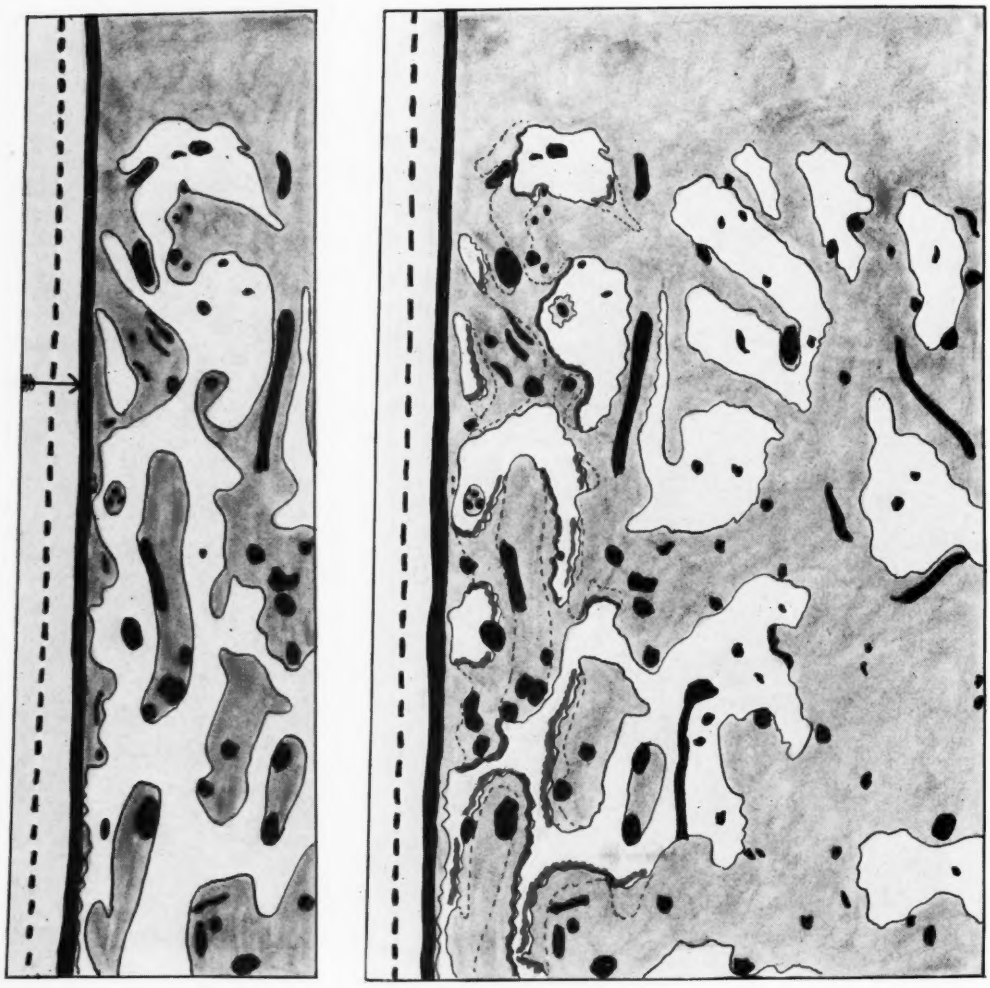
Fig. 3, Cont'd.—*C*, Further changes with pressure.
D, The final restoration of the peridental membrane to its original thickness after cessation of pressure.

taching the cementum to the surrounding alveolar process (*AP*). The alveolar bone is irregularly channeled by the medullary canals of various sizes containing marrow, blood vessels, and nerves (*M S*).

Suppose a slight pressure is brought to bear upon the tooth, moving it from left to right. The degree of movement is indicated in Fig. 3 *A* by the heavily dotted line showing the original position of the root. (Unnecessary details have been omitted from the subsequent sketches; only those tissues are shown which

are particularly subject to changes as a result of the movement of the tooth.) The areas of the peridental membrane and marrow are lightly shaded, while the bone is shown in outline. The vessels of the peridental membrane are strongly marked to show the variations in size resulting from the pressure of the encroaching tooth.

As a result of the compression of the peridental membrane between the root and the surrounding lamina dura of the alveolar process, the vessels are reduced



A *B*

Fig. 4.—*A*, A diagram showing the result of extreme pressure (in the direction of the arrow) on the same alveolar crest as Fig. 2. The surface of the root has been brought into close contact with some eminences of the lamina dura with resulting necrosis.

B, Effect of extreme pressure on lamina dura. The original outline of the bone is shown by dotted lines. Resorption has become active in the rear of the lamina dura as indicated by the red lines with increase of blood supply in these areas.

in diameter (Fig. 3 *A*). The movement of the tooth, however, has not been so extreme as to force the surface of the root against any portion of the lamina dura. The first effect of pressure on the lamina dura is the resorption of all those areas which are under stress (Fig. 3 *B* in red). This can be observed after only twenty-four hours. In Fig. 3 *B* we note the original outline of the alveolar

process in faintly dotted lines, indicating the amount of bone destruction which has taken place. The diameter of the blood vessels of the peridental membrane increases as a result of a diminished pressure following the partial resorption of the lamina dura.

The lamina dura, as noted in Fig. 1, is a fairly thin layer of compact bone tissue surrounding the root. Farther inward the bone is less dense and of a more cancellous structure. Resorption naturally attacks the lamina dura first

Fig. 4 *C*.—Effect of extreme pressure on lamina dura. This diagram shows further bone resorption. Free movement of the tooth is hindered as portions of the lamina dura are still in contact with the alveolar process.

as a result of the movement of the teeth. If bone formation in the depths did not go hand in hand with bone resorption, the lamina dura would be completely obliterated; and the tooth would not be firmly retained in the alveolar process. Fig. 3 *B*, however, shows that in the interior new bone is being formed (shown by green lines) which maintains the normal thickness and strength of the lamina dura. The medullary canal in the middle of the specimen is being moved bodily away from the approaching tooth. This is achieved by bone formation in the interior of the canal on that margin nearest the root, and by bone

resorption on the opposite surface. Fig. 3 *C* shows further changes. Fig. 3 *D* shows the condition after the cessation of the pressure, when the peridental membrane has been restored to its original thickness.

CHANGES IN THE PERIDENTAL MEMBRANE AND BONE AS A RESULT OF EXTREME PRESSURE

The group of diagrams shown in Fig. 4 depicts the same crest of the alveolar process as seen in Fig. 2. In this case notably different changes in

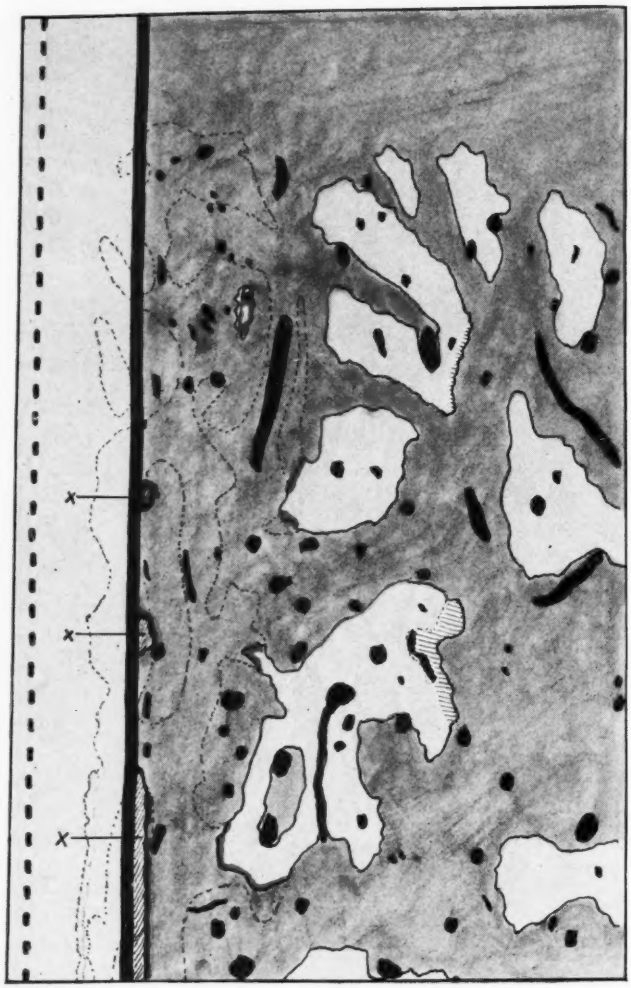


Fig. 4 *D*.—Further changes with extreme pressure. The islands of bone on the surface of the cementum have lost their union with the surrounding bone, shown by crosses. The tooth is loose.

the alveolar process were the result of an extreme, constant pressure exerted on the tooth. The size of the blood vessels in Fig. 4 *A* is shown to be considerably reduced as a result of the compression of the peridental membrane. We may observe further that the surface of the root of the tooth has been brought into close contact with some eminences of the lamina dura, shown in the middle and lower portions of the diagram. Such a contact of the bone and tooth took place in the experimental animals more often at the crest of the alveolar

process than at the apex of the opposing side. The peridental membrane has been traumatized in these areas (Fig. 4 *A*), with a resulting necrosis. *Immediate resorption of bone covered by necrosed peridental membrane cannot take place.* We see in Fig. 4 *B* that resorption has become active in the rear of the lamina dura, accompanied by an increased size of the vessels; this results in an increase of blood supply. Fig. 4 *B* shows the original contours of the bone in dotted lines. It appears that considerable destruction has taken place, leaving unaffected, however, those parts of the lamina dura which had come into close con-

Fig. 4 *E*.—Further changes with extreme pressure. A great amount of bone has been destroyed (dotted lines), and new bone formation is progressing in the depths (green lines).

tact with the cementum of the root. Fig. 4 *C* shows further bone resorption. leaving portions of the lamina dura still in contact with the surface of the root. These are still joined to the surrounding alveolar bone; for, if this were not the case, the constant pressure which is being exerted on the tooth would permit the root to move.

Fig. 4 *D* shows the three contact points of the lamina dura on the surface of the cementum. These, however, have evidently lost their union with the

surrounding bone. This has freed the tooth and permitted a marked movement from left to right. The islands of bone on the surface of the cementum have been reduced to a mere vestige; their position is indicated by three crosses.

Extreme pressure on teeth apparently does not cause a rapid movement in the initial stages. This is probably due to a partial traumatization of the peridental membrane caused by the root surfaces having been brought into contact with the lamina dura. As resorption of the bone cannot take place at

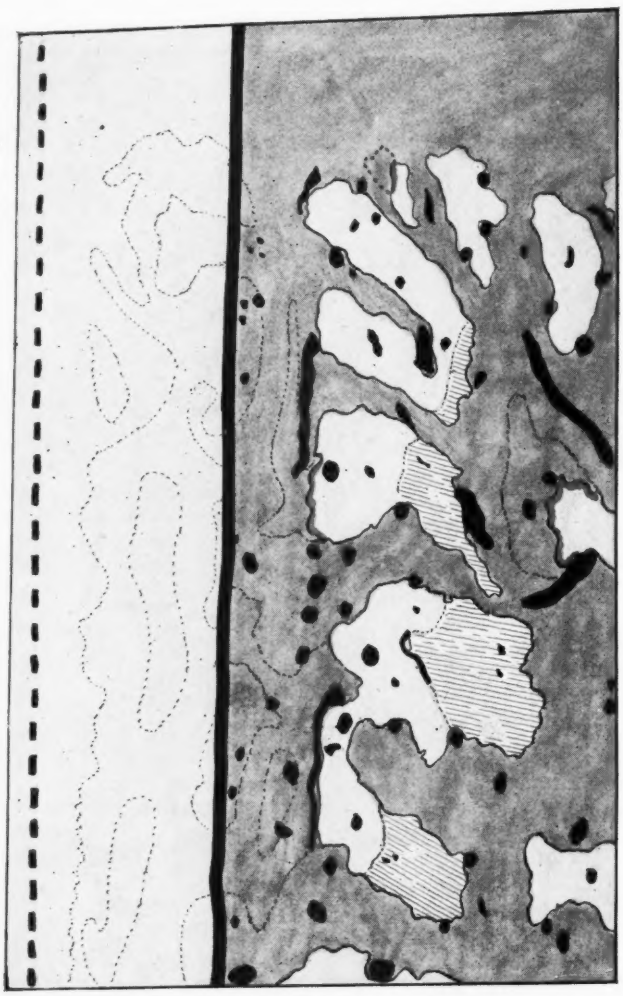


Fig. 4 *F*.—Further changes with extreme pressure. A new lamina dura is being built.

these contact points, but must work from within outward, the tooth cannot move until these are eliminated. When this has been achieved, the complete lamina dura in this area has been destroyed, leaving a peridental membrane of extreme width. This permits a rapid movement of the tooth. Teeth in this condition are markedly loose.

Figs. 4 *E* and *F* shows that the tooth has further progressed from left to right. The last traces of the contacting lamina dura are noted on the surface of the cementum (*X*). The amount of bone destruction that has taken place may be noted by comparing the original outline of the lamina dura (in dotted lines)

with the present contour of the alveolus. Bone formation is progressing (shown by lines, green) in the depth, thus making a start in transforming the cancellous bone into a new lamina dura.

Fig. 4 *G* shows the cessation of the movement of the tooth and a slowing down of the resorption process. The peridental membrane has returned to its approximate normal thickness, and the cancellous bone is being further transformed into a new lamina dura.

Fig. 4 *G*.—Late stage of change under extreme pressure. The tooth has ceased moving and the peridental membrane has returned to its normal thickness. The new lamina dura has its trabeculae laid down at right angles to the long axis of the tooth. In the final stage the islands of bone join to form the completed lamina dura.

It appears that, as a result of the extreme pressure which was brought to bear on this tooth the trabeculae of the new bone are laid down at right angles to the long axis of the tooth (Fig. 4 *G*). Oppenheim of Vienna, in his classic experiments on monkeys concerning the changes of the alveolar process as a result of the movement of teeth, came to the conclusion that this result occurs constantly. He believes that there is always a rearrangement of the trabeculae of the bone outside of the lamina dura which results in their being laid down at

right angles to the root. Gottlieb and Orban evidently did not come to the same conclusion. From their observations it appears to occur only when extreme pressure completely destroys the lamina dura.

DAMAGE TO CEMENTUM

This appears to take place occasionally as a result of the use of excessive pressure on the teeth. Observations on this condition will be made in describing a selection from the book's illustrations.

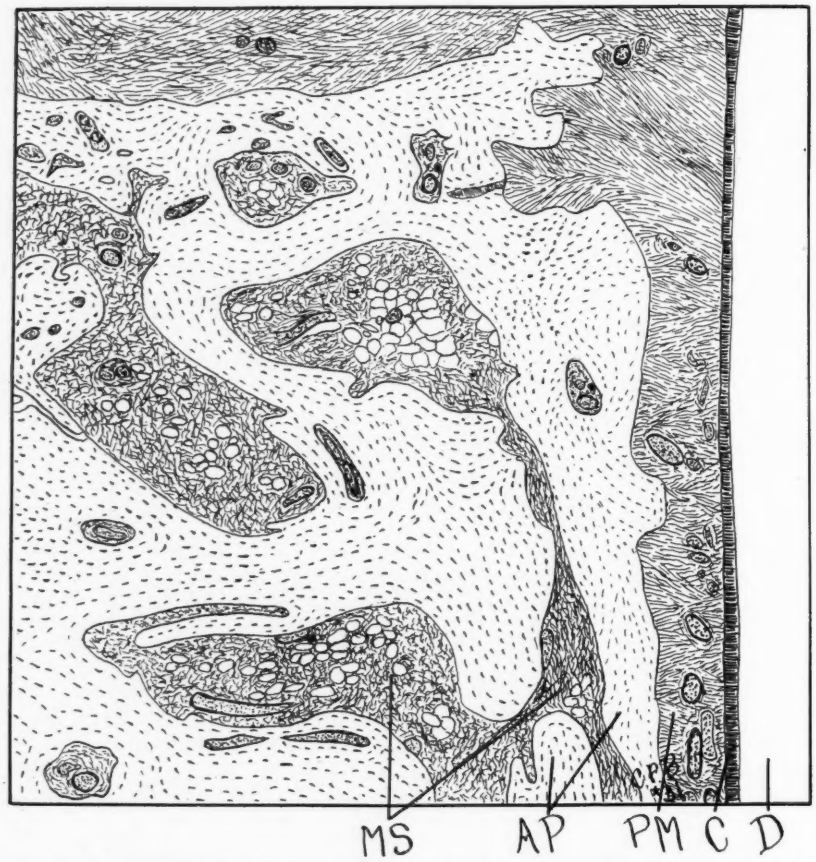


Fig. 5.—A drawing of the distal alveolar crest of the premolar shown in Fig. 1. *D*, dentin; *C*, cementum; *PM*, peridental membrane; *AP*, alveolar process; *MS*, medullary spaces. Note size and shape of vessels.

EFFECT OF TENSION OF THE PERIDENTAL MEMBRANE ON THE ALVEOLAR PROCESS

Tension on the peridental membrane naturally has an effect on this tissue and the alveolar process entirely different from that of pressure. This will be shown in the following diagrams. Fig. 5 illustrates the distal crest of the alveolar process of the tooth depicted in Fig. 1. The surface of the root with its dentin (*D*) and cementum (*C*) are seen, as well as the peridental membrane (*PM*) with its fibers and blood vessels. The irregular contours of the laminated bone are shown with bone cells arranged along their margins. Medullated canals of various sizes may be noted in the alveolar process containing blood vessels, nerves, and marrow.

Fig. 6 *A* shows that the root of the tooth has moved away from the lamina dura. The amount of root movement is indicated by the arrows above and below in Fig. 6 *A*. The thickness of the peridental membrane has been greatly increased as a result of the tension, while the blood vessels (*V*) have changed from a round to an elliptical form. The illustration shows that the lamina dura (*LD*),

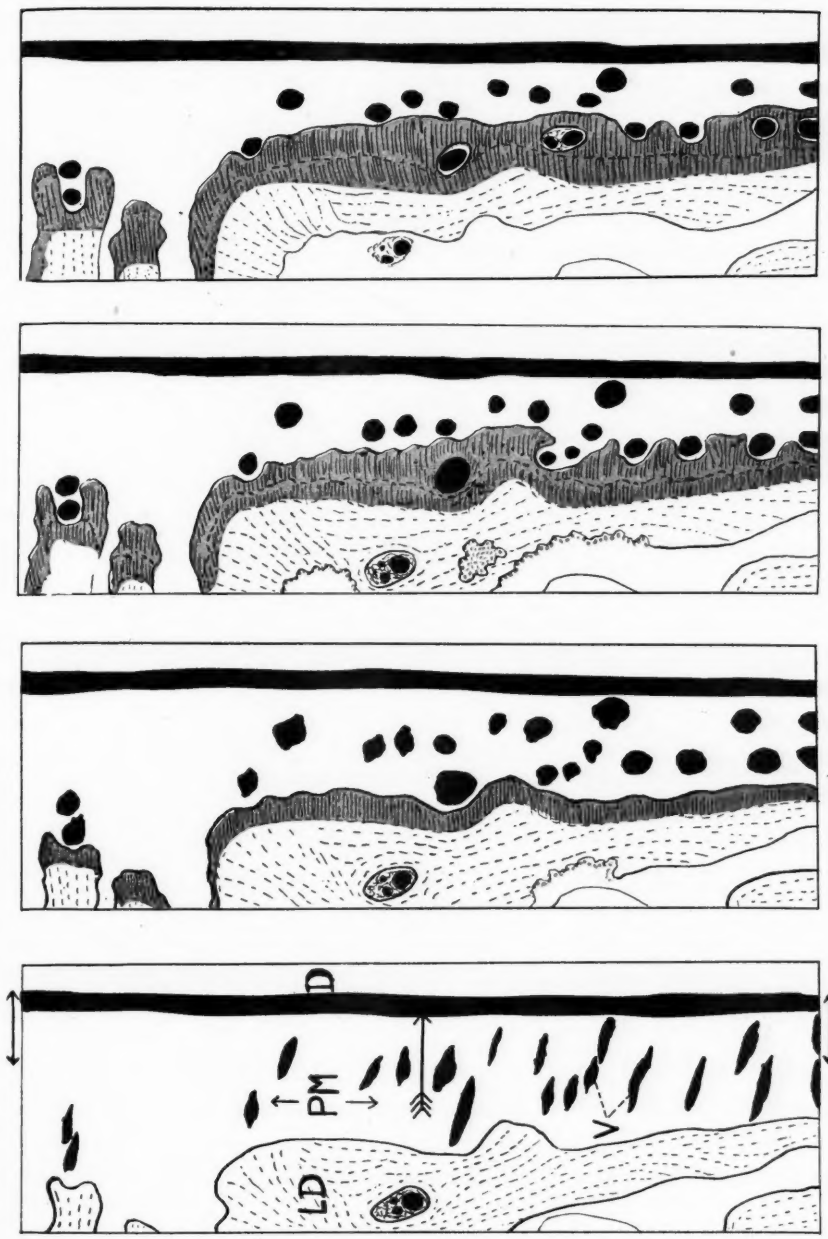


Fig. 6.—*A*, A diagram depicting the result of tension on the distal alveolar crest shown in Fig. 5. The amount of root movement away from the lamina dura is indicated by the arrows above and below. Note the change in shape of the vessels of the peridental membrane due to the tension.
B, Effect of tension on lamina dura. Bone development is indicated by the green lines. The red lines indicate resorption in the interior.
C, Further changes in lamina dura with tension. Bone formation is indicated by green lines.
D, The final changes occurring under tension. The peridental membrane is now of normal thickness. The lamina dura is also reduced to normal thickness. Resorption has come to a standstill.

to which the fibers of the peridental membrane are attached, begins to change its outline inside of twenty-four hours. This is effected by bone development on all those surfaces of the lamina dura which are under the tension of the fibers of the peridental membrane (Fig. 6 *B*, green). If bone formation were to proceed until the normal thickness of the peridental membrane were reestablished, the

lamina dura would acquire an undue thickness. For this reason, apparently, bone resorption (red), noted first in Fig. 6 *B*, progresses internally, so that the lamina dura is finally reduced to its normal thickness (Fig. 6 *C* and *D*).

The cementum is less often affected as a result of tension; on rare occasions it shows increased thickness. This also will be discussed in connection with the illustrations.

With the fundamental principles involved in tooth movement under varying degrees of pressure and tension defined by means of diagrams, a later discussion of some of the illustrations of the work of Gottlieb and Orban may be of greater interest and benefit. Before taking up the illustrations, however, it may be useful to consider the histologic changes of the peridental membrane and bone more in detail.

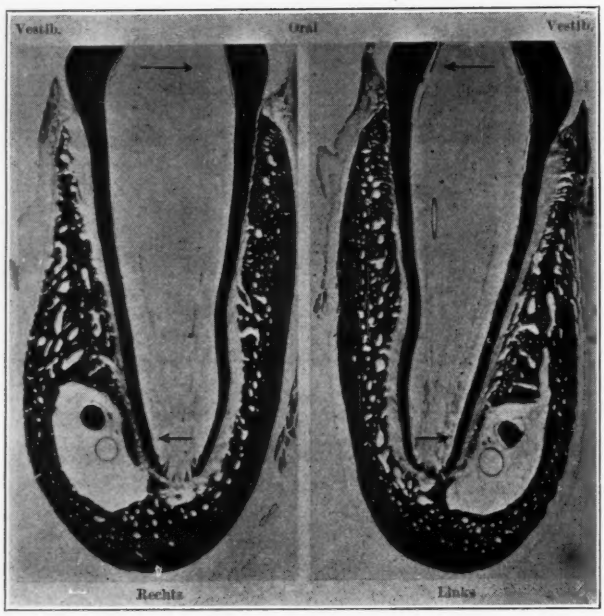


Fig. 7.—Section of right and left canines of very young dog showing effects of thirty-six hours of pressure in direction indicated by arrows. The pressure was strong on the right canine causing traumatization of the peridental membrane at the crest of the alveolus and a narrowing at the apex. The lesser pressure exerted on the left canine caused only a thinning of the peridental membrane at the crest of the alveolus and in the apicial region. (From Gottlieb and Orban.)

THE EFFECT OF A VARYING DEGREE OF PRESSURE ON THE PERIDENTAL MEMBRANE

(1) *Slight pressure* (Fig. 1, arrow) results in a relaxation of the fibers of the peridental membrane at the mesial crest. Localized relaxation of the fibers of the peridental membrane takes place during mastication resulting in no resorption of bone; therefore the physiologic thickness of the peridental membrane is maintained.

(2) *Somewhat higher constant pressure* causes a thinning of the peridental membrane in the areas of stress beyond the physiologic variation, and results in resorption of alveolar bone within twenty-four hours. This resorption continues until the normal thickness of the peridental membrane is restored.

If the pressure, not exceeding the rate of the resorption of the bone, is constant, the movement of the tooth may be long continued without ill effects.

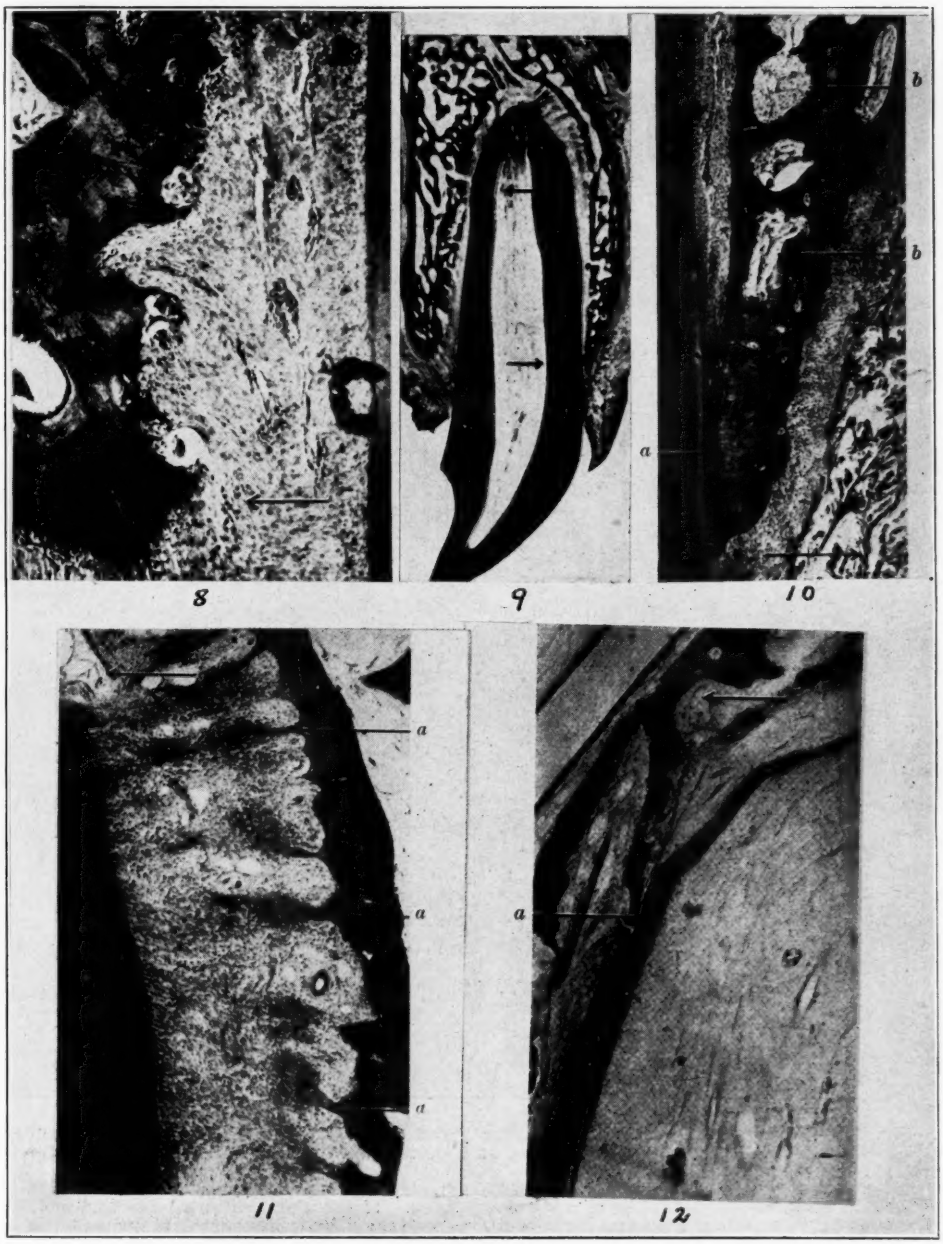


Fig. 8.—Slight pressure exerted for twenty-four hours on the left maxillary incisor of a very young dog in direction of arrow caused active resorption of the crest of the alveolar process on the left.

Fig. 9.—Low enlargement of tooth of very young dog showing the effect of excessive stress on thickness of peridental membrane in cervical and apical areas. Higher enlargements seen in Figs. 9 and 10.

Fig. 10.—Higher enlargement of Fig. 9 showing crest of alveolus under stress; peridental membrane traumatized and necrotic *(a)*. Consequently resorption cannot take place here but starts above, particularly in medullary spaces *(b)*.

Fig. 11.—Same as Fig. 9 showing apical region under tension. Great increase of thickness of peridental membrane resulting in rapid bone growth.

Fig. 12.—Maxillary canine of very young dog; three days' stress. Apical portions of incompleted root forced against lamina dura *(a)* resulting in bending of newly formed dentin. (Figs. 8-12, from Gottlieb and Orban.)

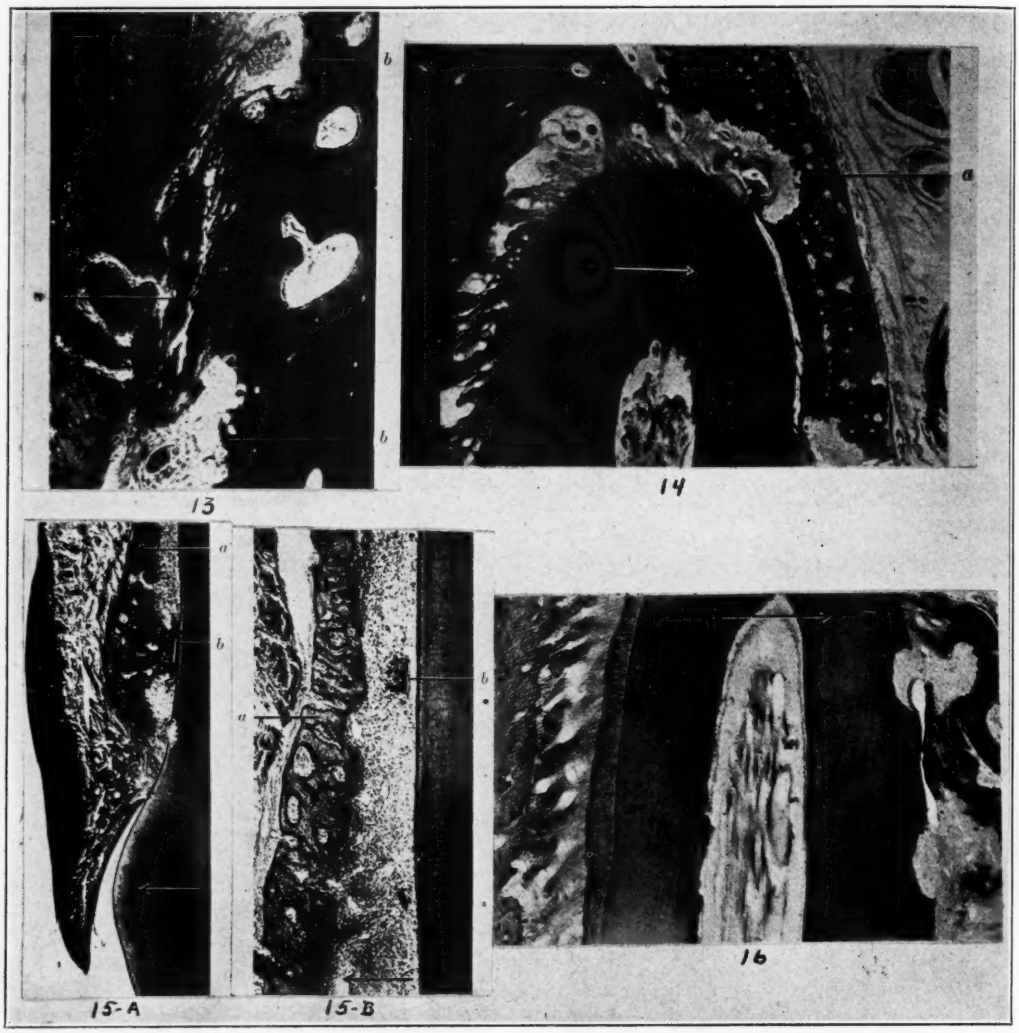


Fig. 13.—Young dog; tooth under stress three days. Calcification of traumatized peridental membrane at *a* with active resorption at *b* thus undermining lamina dura from above and below root surface on the left.

Fig. 14.—Young, completely developed dog; stress twenty days. Traumatization of a considerable area of peridental membrane near apex. Resorption active above and below *(a)* breaking down both the old lamina dura and newly formed bone developed to protect the nerve canal seen at the right. Root surface has remained intact.

Fig. 15.—*A*, Young dog; stress three weeks. No proliferation of epithelial attachment. Original lamina dura completely destroyed except at *b* where peridental membrane was traumatized; resorption active above and below. At *a* bone forming new lamina dura. Areas of slight root resorption are visible.

B, Same tooth as shown in Fig. 15*A*, farther towards the apex. Remains of lamina dura being destroyed *(b)*. Alveolus bounded only by new bone. No resorption of root surface, as stress is never so severe here as at crest of alveolar process.

Fig. 16.—Completely developed young dog; stress one and one-half months. Contacting lamina dura near apex at the right being resorbed from above and below causing destruction not only of bone but also of cementum and dentin. On the left, the lamina dura is under tension resulting in bone formation. (Figs. 13-16, from Gottlieb and Orban.)

EFFECT OF TENSION ON THE PERIDENTAL MEMBRANE

No severing of the fibers of the peridental membrane has been observed in experimental animals as a result of tension on the teeth, even though the space between the root and the adjacent alveolar process has been greatly enlarged (Fig. 11). In certain cases exudates occurred in the peridental membrane, accompanied by the rapid growth of bundle bone.

CHANGES IN BONE AS A RESULT OF PRESSURE

A thorough comprehension of the changes that take place in the bone as a result of a varying degree of pressure appears to be important in successful orthodontic treatment. Clinical observations of orthodontists that a slight, constant

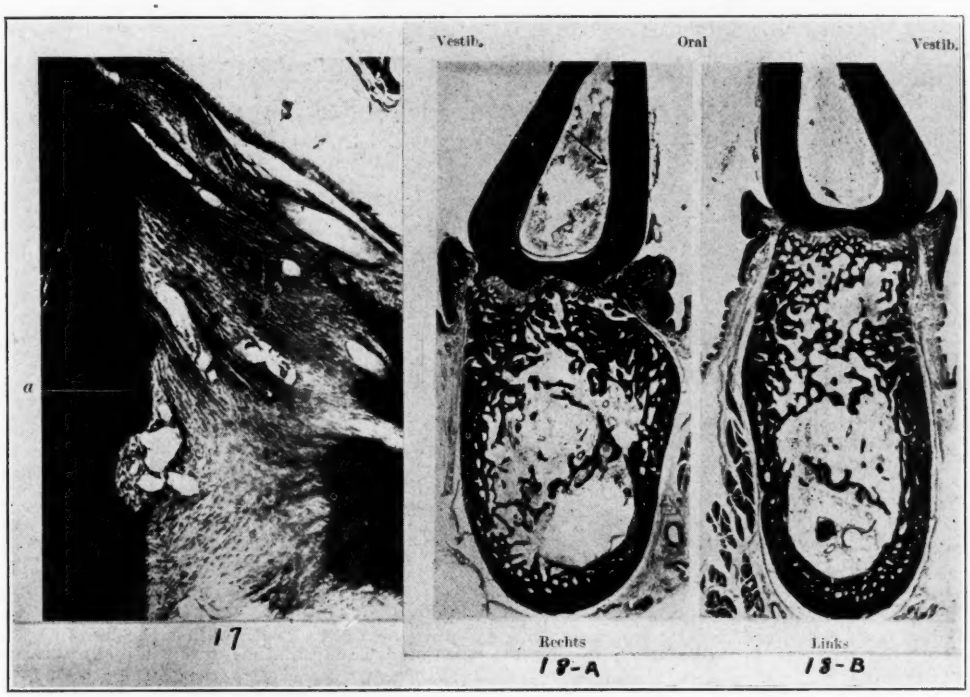


Fig. 17.—Very young dog; stress one month, eighteen days. Remains of lamina dura at *a*. Below, destroyed cementum and dentin being repaired by osteoid tissue.
Fig. 18*A* and *B*.—Very young dog; stress on mandibular right molar, the left tooth serving as control. The right shows increased density of bone at the lingual area as a result of the stress. (Figs. 17 and 18, from Gottlieb and Orban.)

pressure should be used in bringing the teeth to their normal occlusion are now scientifically established by Gottlieb and Orban, who show the reasons for this.

The major part of the resorption of the alveolar process takes place in the lamina dura whenever pressure has not been so extreme as to cause a strangulation of the capillaries of the peridental membrane and the necrosis of this tissue (shown in Fig. 8). Where strangulation has taken place and the cementum of the root has come into close contact with certain areas of the lamina dura, resorption from this area does not occur. In this case, bone destruction takes place in the interior, gradually undermining those portions of the lamina dura which are in contact with the cementum of the root, and in the end completely destroying these contact points. Such internal resorption also occasionally takes place in

the bone marrow spaces underlying those areas in which the peridental membrane has not been completely crushed. (Figs. 12, 13, 14, 15 *A* and *B*.)

New bone formation takes place in the depths of this area, nature's provision that the alveolar process around the moving tooth is not unduly weakened. Therefore, only where the original bony lamina is exceedingly thin (such as on the buccal plate in the maxilla) and the pressure is excessive, is the alveolar wall completely resorbed. This leads to a marked loosening of the tooth.

Bone formation and bone destruction are constantly active. Both these processes may sometimes be noted on the boundaries of a medullary canal. The side nearest the approaching tooth may show osteoblasts (bone formation) while

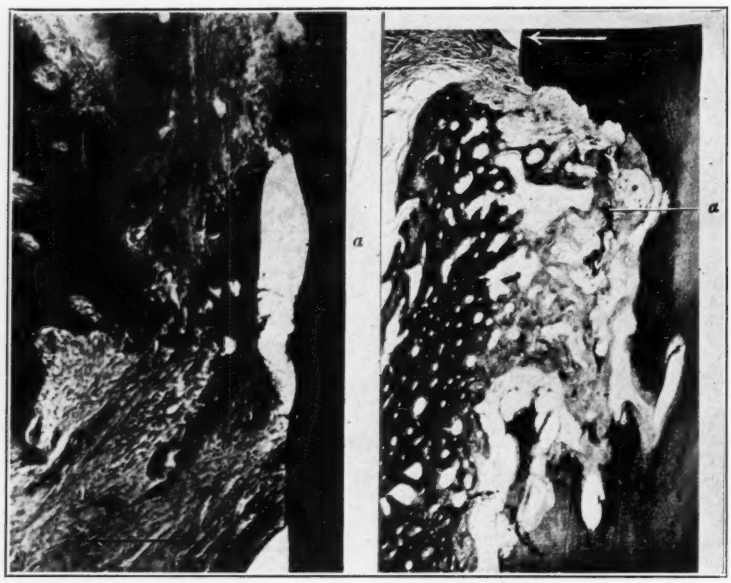


Fig. 19 Fig. 20

Fig. 19.—Fully grown dog; stress two months, twenty-four days. The surface of the root *(a)* has been destroyed, not by resorption but by abrasion of the root against the bone as a result of the movement of the tooth during mastication. The remains of the lamina dura are still visible.

Fig. 20.—Fully grown dog; stress six months, twelve days. Extensive resorption of root resulting in ankylosis; alveolus dovetailed into irregularly resorbed areas. (Figs. 19 and 20, from Gottlieb and Orban.)

on the other side osteoclasts will be active. Through such a combination of forces the position of the medullary canal may be moved away from the approaching tooth (Fig. 3 *B*).

The rapidity with which the alveolar process may be resorbed during the movement of the teeth appears to be greatly dependent upon the age of the animal; progress is usually more rapid in the young than in the older animals. This is probably attributable to the reduced reaction of the connective tissue and the lessened blood supply. The slower movement of the teeth observed in older animals is explained not only by the reduced rate of resorption of the lamina dura, but also by the slower resorption of the deeper areas of the bone. (This was mentioned in connection with the crushed and necrotic areas of the peridental membrane.) The internal resorption, which takes place in case of trauma of the peridental membrane next the affected areas, occurs not only in the medul-

lary spaces immediately beneath the affected areas, but also some distance above and below this zone (Figs. 14 and 16). The fatty marrow contained in the medullary spaces becomes fibrous in nature, as a result of pressure from the moving tooth; later, when the normal width of the peridental membrane has been restored by the resorption of the bone, fat again appears in the medullary spaces.

EFFECT OF TENSION ON THE BONE

Changes take place in twenty-four hours in those bone areas where the peridental membrane is under tension. Sharpey's fibers appear to crop from the surface of the lamina dura in bone adjoining such membrane (Fig. 11). Osteo-

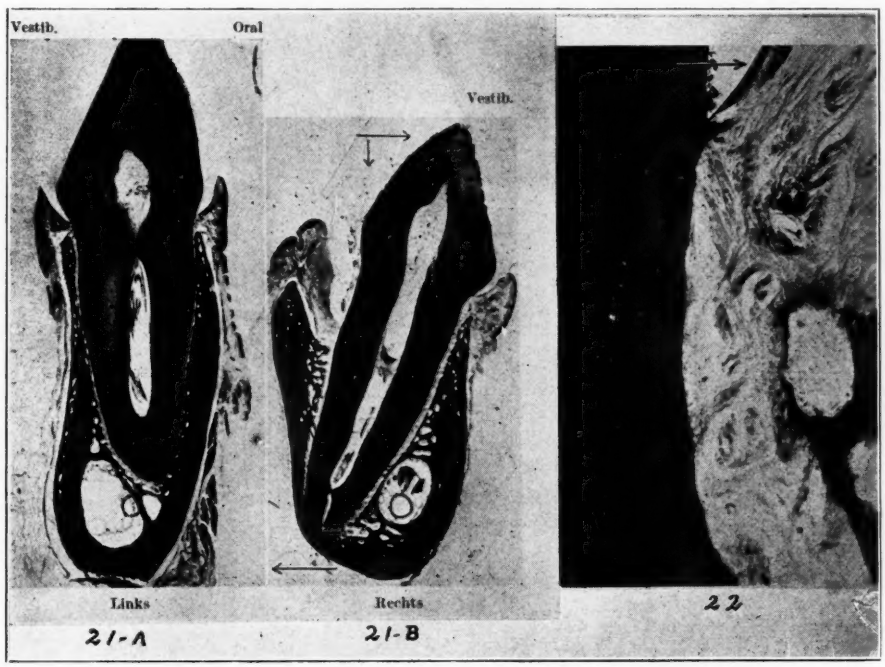


Fig. 21*A* and *B*.—Young dog; stress thirteen months. Transformation of the entire form of the mandible with a change of the relationship of the inferior dental canal to tooth, as a result of stress on the right tooth. (*B*) Note development of lingual gingival pocket.

Fig. 22.—Higher enlargement of a part of Fig. 21*B* showing the crest of the alveolar process under stress. Resorbed root surface has been repaired with several layers of osteoid tissue. The epithelial attachment has not proliferated into the depths as a result of the trauma but has remained at the cementoenamel junction. (Figs. 21 and 22, from Gottlieb and Orban.)

blasts arrange themselves around these bundles of fibers, and bone formation begins. In this manner a great many protuberances are formed on the surface of the original lamina dura; the depression between each two of these may harbor blood vessels. Bone formation also progresses in the depressions or valleys, so that the previously enlarged space formed by the movement of the tooth between the root and the lamina dura is filled in with bundle bone. Thus the blood vessels which were originally in the peridental membrane become engulfed in the alveolar process. Resorption begins in the interior of the bone apparently to reduce the unnecessary thickness of the lamina dura. This is achieved by honeycombing the compact bone tissue of the lamina dura in the interior and changing it to cancellous bone (Figs. 10 and 13).

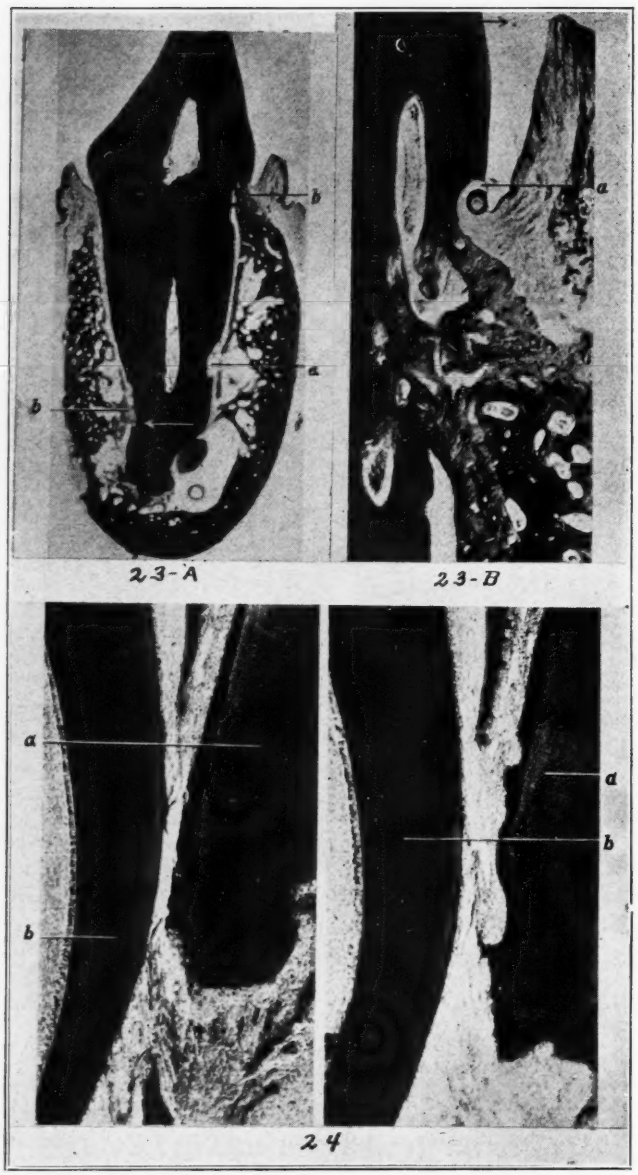


Fig. 23.—*A*, Old dog; duration of experiment four months; stress one month, four days followed by release of the tooth. Ankylosis at areas marked *b*.

B, Alveolar crest of Fig. 23*A* showing higher enlargement of ankylosed area. Canalization of the dentin under the cervical enamel is visible, accompanied by osteoid tissue formation in resorbed areas reaching even to the enamel *(a)*. The epithelial attachment is in its normal position and has not proliferated into the depths.

Fig. 24.—Peppo (monkey). Two different sections of the same series. The older permanent molar *(a)* has come into contact with the root of the younger molar *(b)* causing a resorption of the older tooth. (Figs. 23 and 24, from Gottlieb and Orban.)

Fig. 25.—Human second premolar and second molar of twenty-four-old person. Stress of mastication was forcing second molar forward into the space of the first molar. The apices of the roots were being forced distally. The changes in the peridental membrane and alveolar process resulting from the drifting of the second molar are closely similar to those observed in the experimental dogs. (See also Fig. 20.)

Fig. 26.—Roots of second molar shown in Fig. 25 under higher enlargement. The distal areas of the apices have been forced into contact with the laminae durae, showing traumatization of the peridental membrane as severe as in the animal experiments. Bone development is active at the areas under stress *(a)*.

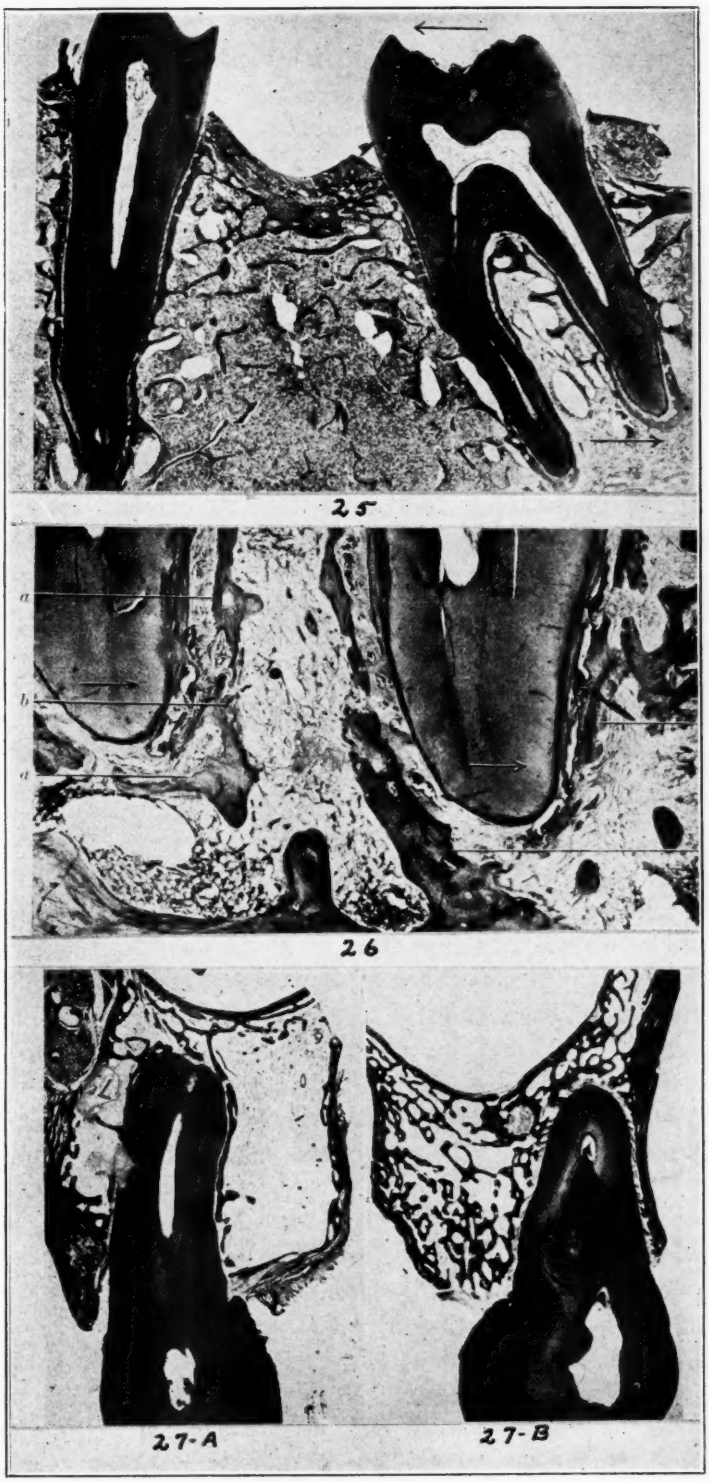


Fig. 27.—A functionless (*A* on the left) and a functioning maxillary human molar (*B* on right). The alveolar process of the functionless tooth (left) is barely developed, showing only the lamina dura. Surrounding the right tooth we note that normal cancellous bony tissue has been maintained as a result of function. (Figs. 25-27, from Gottlieb and Orban.)

CHANGES IN THE CEMENTUM AS A RESULT OF PRESSURE

The cementum covering the root of the tooth is not readily affected by pressure resorption. This is particularly true when the pressure is not exerted for more than two weeks and is not too intense.

Several factors appear to influence the resorption of the cementum and dentin in the experimental movement of teeth. First, age. The older the animal, the greater is the danger of resorption. Second, constitutional differences which favor or inhibit resorption. A third factor is of particular importance to the orthodontist. The original bone surrounding the root at the beginning of orthodontic treatment appears to be resorbed more readily than that bone which is formed when the tooth comes again to a standstill. If orthodontic treatment is temporarily interrupted on children, thus permitting the process of resorption to be checked, with the formation of a complete lamina dura, renewed pressure forces the root against recently organized bone. As noted, such bone appears to be more resistant to resorption than the original bone; consequently there is danger that the surface of the root may also be resorbed on account of the increased pressure necessary to bring about a further movement of the teeth (Figs. 15 *A*, 16, 17, 20, 23).

THE EFFECT OF TENSION ON CEMENTUM

Those areas of the root which are placed under tension, with resultant rapid proliferation of bone, show an increased thickness of the cementum only in the rarest instances.

ANKYLOSIS

There appear to be different degrees of ankylosis which lead to the firm attachment of certain areas of the root of the tooth to the surrounding alveolar process. Ankylosis usually results from a calcific degeneration of the necrosed remains of the peridental membrane; it causes a firm locking together of bone and tooth. Such calcified remains of the peridental membrane either may be resorbed, thus freeing the tooth, or may later be transformed into bone locking both firmly. Such areas of ankylosis usually show that the cementum and part of the dentin have been resorbed. This explains the firm connection which nature establishes by dovetailing the root of the tooth and the surrounding alveolar process (Figs. 13, 20, 23 *B*).

Why does ankylosis occur so rarely under normal conditions? The theory that the constant movement of the teeth during mastication prevents their union with the alveolar process is denied by both Gottlieb and Orban. Another theory is presented by I. Robinsohn, that the presence of the epithelial structures (glands of Serres or glands of the peridental membrane) prevents an ankylosis of the cementum and the surrounding alveolar process. Gottlieb and Orban do not consider this to be the true explanation. They believe that ankylosis is a pathologic condition brought about by two abnormal factors: the damaging of the peridental membrane as a result of excessive trauma, and the resorption of the cementum and even of the dentin, which results in dovetailing the root and the lamina dura (Figs. 20, 23 *B*).

THE EFFECT OF TRAUMATIC OCCLUSION IN DEVELOPING PYORRHEA AND THE MIGRATION OF THE EPITHELIAL ATTACHMENT

Gottlieb's and Orban's principal motive in this extensive series of experiments was to test the truth of the theory that traumatic occlusion is the prime factor in loosening the teeth, thus causing pyorrhea. In not one of the experimental animals was loosening of the teeth under stress to be noted if the stress was applied along the axis of the tooth. Only in certain cases in which the stress was more nearly lateral, so that resorption of the thin labial plate of the alveolar process was effected, did it cause a permanent loosening of the tooth. Gottlieb and Orban also believe, on the basis of their experiments, that traumatic occlusion does not cause a proliferation of the epithelial attachment into the depths of the gingival crevice (Figs. 22 and 23 *B*).

In closing, I wish to say that I believe that the book of Gottlieb and Orban is one of the most valuable contributions that the science of orthodontia has received in years. However, further work remains to be done in this field by using, on experimental animals, orthodontic appliances with carefully measured tension. Thus we may obtain an idea of the different reactions in the bone and peridental membrane of dogs under measured degrees of stress.

630 West 168th Street.

EVOLUTIONARY TENDENCIES IN THE JAWS*

PROFESSOR G. ELLIOT SMITH, F.R.S., LONDON, ENGLAND

IN SEEKING an explanation of the strange vicissitudes to which the teeth are liable in the course of their development in man, it is important not to lose sight of the factors involved in the making of the human face and in providing it with new functions in addition to those it performs in other living creatures. The changes which affect the jaws and teeth in the evolution of man are in large measure due to the growth of the brain and the enhanced significance of the face which the higher powers of visual discrimination and understanding confer upon it. It is not only the most distinctive label of individual men and women, whereby their fellows recognize them, but also the chief instrument for expressing the feelings and thoughts in a way that plays so vital a part in social intercourse and in enabling human beings to express their own personalities and to influence the behavior of others.

Profound changes were effected in the face in man's remote ancestors during the process of acquiring the higher powers of vision, which were made possible by an alteration in the position of the eyes, the reduction and transformation of the snout, and what amounted to a profound reconstruction of the jaws and consequential changes in the number, form, and sequence of eruption of the teeth. Moreover, the growth of the larger brain and the cultivation of its complicated functions called for much more time than was required for its development in other creatures, and during the years occupied in these processes the eruption of the teeth was delayed. Most of the problems which are responsible for the creation of the orthodontic profession arose out of the circumstances created by these delays in the growth of the jaw while the brain was developing. If esthetic considerations and men's interest in faces played some part in creating the demand for orthodontia, the growth of the brain was chiefly responsible for disturbing the orderly process of uniform growth of the jaws from which the dental troubles arose. Man had inherited from his immediate ancestors the same number, type, and order of formation of the teeth. Even if nothing more of fossil apes and men had been recovered than their teeth, it would still have been possible to establish so complete a series of links as to bridge the gap between the living apes and men by following their respective lines of divergent ancestry back step by step to a common parent akin to a fossil ape such as *Dryopithecus,* which lived in the Indian Sivaliks in the Miocene period. Quite apart from all the other corroborative evidence, the morphology of the teeth, so clearly elucidated by many recent writers, in particular by Professor William K. Gregory and Dr. Milo Hellman,[1] was enough to establish the reality of man's simian ancestry and the nearness of his affinity to the African apes and their extinct Asiatic kindred.

*A summary of an address given before the Second International Orthodontic Congress, London, July 20, 1931.

The facts noted by Gregory and Hellman appear to justify the following inferences, which I quote with slight modifications. To judge from the characters of the dentition, the modern apes are unquestionably man's nearest relatives among known mammals. No other known living or fossil mammals can seriously contest this claim for the anthropoid group. Hence there does not seem to be any adequate reason in refusing to accept this direct evidence and to trace the evolution of the human dentition through that of the primitive anthropoid *Dryopithecus* back to the primitive ape *Propliopithecus,* rather than to invent entirely hypothetic stages leading back to imaginary stem forms in the Paleocene or Upper Cretaceous. The various extinct anthropoids known as *Dryopithecus* are decidedly nearer to the common stem form than are any of the modern giant apes. From some form of *Dryopithecus* man has inherited his dental formula, the "bicuspid" pattern of the maxillary and mandibular premolars, the "*Dryopithecus* pattern" of the molars, many details of the incisors and canines and important characters of the deciduous dentition. This is not a casual speculation but is based upon observations of the characters actually inherited in the more primitive human dentitions. Hence the most illuminating comparisons are provided by contrasting the earliest members of the human family with the living African and the extinct apes of Asia, Africa, and Europe. The great outstanding differences in the jaws of *Dryopithecus* and man, when viewed in the general perspective of mammalian evolution, are seen to be associated with the following changes in the distinctively human line *after* it had branched off from the *Dryopithecus* stem:

(A) A widening of the intercondylar diameter across the jaw associated partly with the enormous expansion of the brain and partly with an increase in the width of the tongue.

(B) A marked retraction of all the front teeth (incisors, canines, premolars) involving an upward and backward movement of the crowns of the slightly procumbent mandibular incisors to a vertical position; a rapid diminution of the mandibular and maxillary canines with eventual covering of the tip of the mandibular canines by the maxillary canine and lateral incisor, a rotation of the crown and roots of the anterior mandibular premolar from a more anteroposterior to a transverse position so that the anterolingual root becomes lingual and the posterobuccal becomes buccal, with subsequent fusing of the roots, this process in the forebears of man going even farther than it has in some modern anthropoids. A widening of the first molar and a marked shortening of the second and third, so that the first molar often becomes the dominant one. A shifting, differential growth, and realignment of the five main cusps of the mandibular molars, involving especially the forward displacement of the entoconid, the very gradual obliteration of the "*Dryopithecus* pattern" and the substitution of the plus-shaped or cruciform pattern.

(C) A retardation in the time of eruption of the third molar which often entirely fails to erupt.

Whatever view may be taken as to the reasons for the development of the human chin, two important facts are established: (a) that between the slightly receding chin of *Dryopithecus* on the one hand, and the most protruding human

chin on the other, more or less intermediate conditions exist, as in the Peking, Piltdown, Heidelberg, Ehringsdorf, Neanderthal, and more primitive modern human jaws, such as those of certain aboriginal Australians and negroes; (b) that, as already noted by Smith Woodward (1914) the symphyseal region of *Dryopithecus* could by slight modifications in either direction give rise to the divergent specializations in typical anthropoids, with an extended simian shelf, or, in modern men, with no simian shelf. Nor does the embryologic evidence cited by Bolk (1915) appear to Gregory irreconcilable with the paleontologic evidence.

These many changes in the jaws and teeth accompanied or lagged behind the great expansion in the prefrontal, parietal and temporal areas of the brain and the development of articulate speech. This admirable summary I have quoted almost verbatim from Gregory and Hellman because it defines the reasons why we must compare the human conditions with those of certain apes if we are to get any inkling of the process of evolution.

In the Proceedings of the Zoological Society of London for 1928, my colleague, Dr. S. Zuckerman, discussed the age changes in the chimpanzee with special reference to growth of brain, eruption of teeth, and estimation of age, with a note on the Taungs ape. In this important study, which includes a comprehensive survey of the literature relating to the age changes in apes and men, the claim is put forward that there is a much closer approximation of the simian to the human conditions than is generally admitted. Dr. Zuckerman says that all the available data indicate that the duration of the chimpanzee stages of tooth eruption are the same as in man. The first permanent molar erupts between five and six years, and the last molar does not erupt before fifteen years, probably later. The other teeth erupt at practically the same time as in man, with the exception of the second molar, which appears early, as far as is known always before the canine, and either before or after the premolars.

It is obvious that the chief interest is attached in these comparisons between men and apes to the relative times of eruption of the second permanent molar and second premolar teeth, which have been discussed at considerable length by Mijsberg and Degerbøl. Zuckerman points out, however, that both in apes and in men the sequence of eruption is subject to variation. In the chimpanzee the second premolar may erupt before the second molar, as in man the second molar may erupt before the second premolar. While these facts emphasize still further the close kinship of man to the African anthropoids, they do not affect the conclusion that as a general rule the second molar erupts before the second premolar in the apes whereas in man the sequence is usually reversed.

The chin is the peculiar distinction of modern man. In the extinct members of the human family the lack of chin development becomes more pronounced as one successively compares with *Homo sapiens* men of the Neanderthal and of the Heidelberg species, until in Piltdown man and Peking man the deficiency becomes so pronounced that some anthropologists still refuse to admit that they are human. It is not only the form and structure of the teeth and jaws of these primitive men, however, that are increasingly apelike, but also the order of their eruption. In the human child there is a delay of four years after the deciduous

teeth are erupted before the permanent teeth begin to be "cut," and another ten or fifteen years may be occupied in completing the permanent dental equipment. In the apes the process of eruption of the permanent teeth follows more closely on that of the first teeth, and the second permanent molar erupts before the deciduous molars are replaced by the premolars. In the children of Neanderthal man the surprising fact is now revealed that the simian type of sequence was retained in the eruption of their teeth. There are reasons for the inference that Neanderthal man's defective chin development may be associated with this fact—that the precocious erupting of his teeth permitted the tooth bearing part of the jaw more nearly to keep pace with the growth of the rest of the jaw. Modern man probably developed a chin because the growth of the tooth bearing part was restrained by the long delay in the eruption of his teeth. There has been much speculation as to why this should be so, especially in recent writings of the late Professor Bolk,[2] Professor Mijsberg[3, 4] and Dr. Deg-

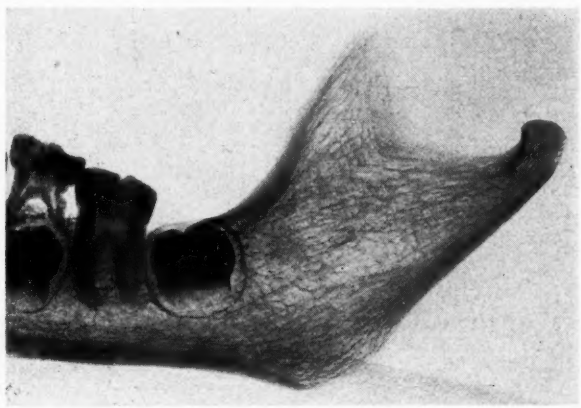


Fig. 1.—X-ray photograph of part of the mandible of a ten-year-old child to illustrate the race between the second premolar and the second molar, which in *Homo sapiens* (but not in *Homo neanderthalensis*) is usually won by the earlier eruption of the premolar.

erbøl.[5] Yet it is strange that none of them has referred to the fact (so strikingly emphasized by my colleague, Professor H. A. Harris, in the *Lancet* of March 28, 1931, and elsewhere) that the human child until the seventh year, during the pause in his dental development, is growing a phenomenally large brain, and for another fifteen years or so, while relatively sluggish in his dental affairs, he is occupied in learning how to put his complicated cerebral instrument to the biologic uses which are vitally essential for human existence. The delay in tooth and jaw development is undoubtedly due to these momentous events. The salient chin is a manifestation of the great events which conferred mind upon its predecessor—it is an index of mental development in the psychologic as well as the anatomic sense of that term.

In this paper I propose to examine the views of these Dutch and Danish writers. Professor Mijsberg of Batavia, amplifying and modifying the views suggested by his master, the late Professor Bolk of Amsterdam, emphasized the fact that the different types of adult jaw in modern man, in extinct types of man, and in the apes are differentiated from a common type as the result of dif-

ferences in the way in which the deciduous teeth are replaced by the permanent teeth. The permanent teeth which replace the deciduous teeth in man do not occupy more room than their predecessors. The alveolar part of the human jaw does not increase in length from the seventh to the thirteenth year, whereas the basal part of the jaw, on the contrary, continues to increase in length, its growth being related with that of the body as a whole. Hence the basal part of the body of the jaw is pushed forward beyond the alveolar part and the protrusion is the mental eminence.

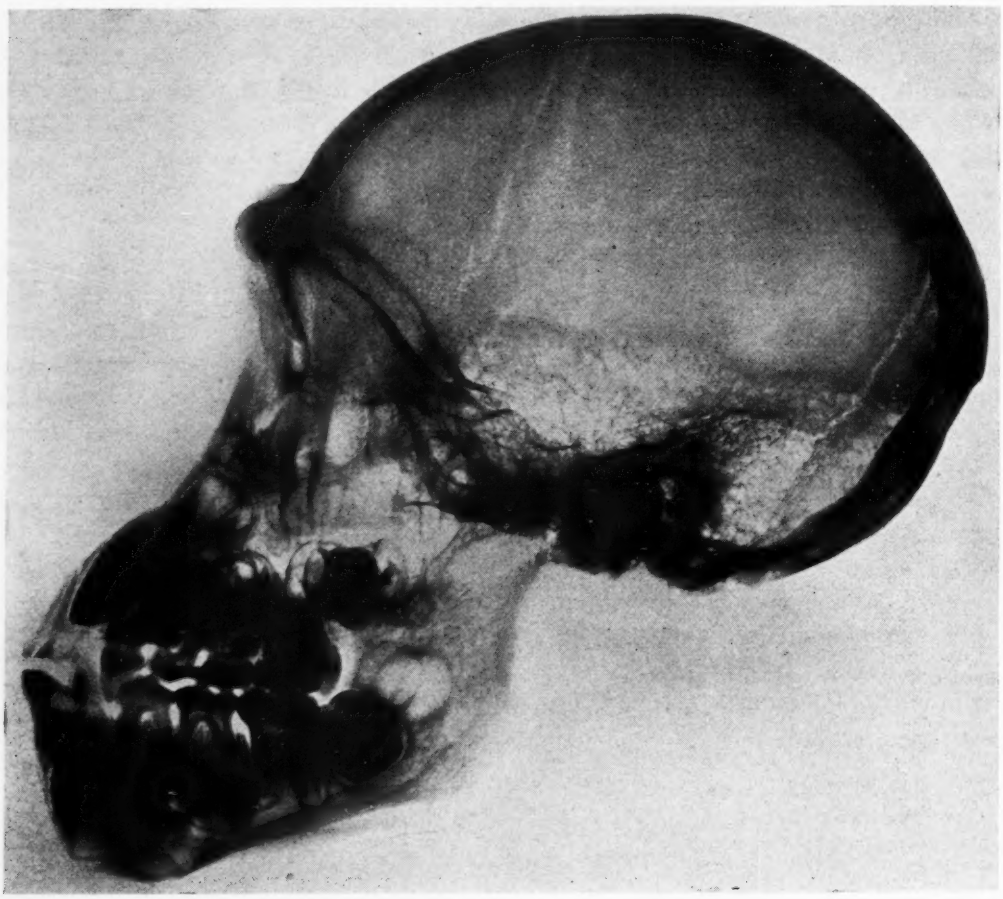


Fig. 2.—X-ray photograph of the skull of a young chimpanzee showing the second molar erupting before the second premolar, a sequence which is also followed in Neanderthal man. (Figs. 1 and 2 are from photographs by F. Melville.)

In the anthropoid apes, on the other hand, the second molar tooth, as a rule, erupts before the deciduous molars are replaced by the premolar teeth. Moreover, the permanent teeth occupy far more room than the deciduous teeth which they replace. Hence the alveolar part of the jaw increases so that it is pushed forward above the underlying basal part. In Neanderthal man, however, in contradistinction to *Homo sapiens*, the second molar teeth (in the two known jaws of the relevant age) erupt before the deciduous teeth are replaced by the permanent set. In this respect they resemble the apes. Unlike the latter, how-

ever, the permanent teeth are not much bigger than the deciduous teeth, so that the increase in length in the alveolar part of the jaw does not exceed that of the basal part to such an extent as is the case in the apes.

The line of investigation developed by Bolk and Mijsberg has been carried a stage further by Dr. Degerbøl. He emphasizes the consideration that between man and the apes there is a difference not merely in the order of sequence, but also in regard to the intervals of time at which the various types of teeth succeed each other. Among the apes the deciduous teeth begin to erupt shortly after birth and, a short time after the last deciduous molar (second premolar) is in its place, the first molar erupts. The permanent canine and the third molar thus come into position almost simultaneously. What characterizes this course of the shedding process is that it is continuous: there is no great interval of time between the eruption of the various types of teeth as is the case in man. In man the deciduous set of teeth is in position at the end of the second year, but it is only at the age of five or six that the next tooth, the first molar, appears and with it the shedding begins. When this is over, the second molar erupts.

In speaking of an interval of rest from the eighth to the fourteenth year, Bolk is of the opinion that during those years there is a dormant period, which, however, does not extend uniformly over the whole time. In fact the second molar already begins to erupt at the beginning of the ninth year and passes the 50 per cent boundary at the age of twelve.

According to Bolk, the deviation in man has its natural explanation in his hypothesis of retardation and fetalization. According to this, the development of man proceeds very slowly compared with that of other animals. This retardation, he thinks, must be due to hormones controlling the metabolic processes. Thus for him the question has become a general physiologic one, and he has not really searched for the specific reasons that are distinctive of man.

According to Bolk the retardation of the molars' eruption is the cause of the prominent chin that is characteristic of *Homo sapiens*, the alveolar part of the mandible forming after the teeth and thus, as the permanent teeth occupy no more space than the deciduous teeth, is checked in its growth, whereas the basal part is not checked but grows forward, whereby the chin projection arises.

In Degerbøl's opinion, the simplest explanation of the relatively late eruption of the molars in man is that there is no room for that eruption earlier. In man the facial bones lie very far back compared with those of other primates, as is shown for instance by the fact that the posterior edge of vomer, which in other primates is usually under the foremost sphenoid element, in man is situated under the hindermost part of the sphenoid bone. As a consequence the maxilla has become shortened, and this has necessarily involved the shortening of the alveolar part of the mandible. The consequence of this again is that only after years of growth is there room for the eruption of the molars. The formation of the chin is also influenced by it, but the primary cause, of man's projecting chin is attributed by Degerbøl to man's upright posture and the consequent advancement of the foramen magnum. In this manner pharynx, larynx, and hyoid bone, and the muscles connected with them, are pressed forward. The whole issue then turns upon the question of room for these muscles: with a receding

chin they would not have space in which to work. Degerbøl's claim that these muscles prevent the basal part of the mandible from following the alveolar part in its retreat is difficult to reconcile with the fact that all human beings other than *Homo sapiens* are devoid of a chin.

There is another circumstance which Degerbøl believes to support the view that lack of room brings about the later eruption of the molars. It is only the emergence from the gum that is delayed. If we look at the activity that goes on hidden in the jaw, we shall find that the formation of the teeth and calcification of them in man proceed in the same order as in the other primates. At the beginning of the second year, when the last deciduous premolar in man is about to come into position, the crown of the first molar has already been formed. We must therefore emphasize that the first molar in man, with regard to the time and the sequence in which the crown is formed, conforms to the other primates. As the crown lies completed for three or four years without erupting, Degerbøl thinks this must be due to lack of room. Somewhat similar is the case in regard to the second molar. In this case, too, the crown calcifies comparatively early, in the fourth year. At the age of six years it is half formed, but in the maxilla it is "situated high up in the tuberosity of the bone with the occluding surface directed downwards, outwards and well backwards" (Colyer). In the mandible it lies under the base of the coronoid process.

All in all, then, it will be observed that the considerable difference in the eruption of the permanent teeth between man and the other primates, in regard to both chronologic order and sequence, is very greatly reduced when the processes that go on concealed in the jaw are included in our consideration.

That it is lack of room which causes the molars to erupt late in present day man would also seem to appear from what we know about the Neanderthal man. Of this species we know only few jaws of individuals so young that they are in process of shedding their teeth. Hans Virchow has interpreted the evidence in the child's mandible from Ehringsdorf. The second molar erupts before the premolars, that is to say, exactly as in the apes. A similar process has been observed in both the maxilla and the mandible of Neanderthal man from Krapina. Thus Neanderthal man presents the very remarkable feature that in regard to the eruption of the teeth, he resembles the apes. Shedding and the prolongation of the row of teeth are simultaneous. This corresponds very well with the fact that the jaw of the Neanderthal man is bigger than that of present day man. There is sufficient room to permit the teeth to erupt in the order in which they calcify. None of the various reasons given by Bolk, Mijsberg and Degerbøl in attempted explanation of the changes in the times of eruption of the permanent teeth in *Homo sapiens* seems to provide any satisfactory solution of the problem. I am convinced that the circumstances created by the growth of the brain supply the vital factor they have overlooked.

If there is any justification for the view which has been set forth in the preceding paragraphs that the delay in the eruption of the teeth in man hampers the free expansion of the alveolar part of the jaw while the basal part, continuing its normal process of growth, becomes protruded to form the chin, we must not lose sight altogether of the processes of growth that are taking place in the

maxilla. Why, it may be asked, is there no development in the maxilla comparable to that of the protrusion of the chin in the mandible? It may be noted that in those human beings (such as the aboriginal Australian and some negroes) in which the chin is liable to be defectively developed there is also a flattening of the face (Fig. 3), and the question arises whether the greater prominence of the nose and the development of the aquiline form may possibly be an expression of the same sort of tendency as that which in the case of the mandible gives rise to the chin. This suggestion is nothing more than a mere speculation which is mentioned only to answer the objection that there is nothing in the case of the development of the maxilla strictly comparable to the protrusion of the chin in the case of the mandible.

The wider vision of the evolution of the face enables many speculations that are repeatedly being made about human tendencies to be viewed in truer perspective. The reduction in size or the absence of the third molar is often claimed

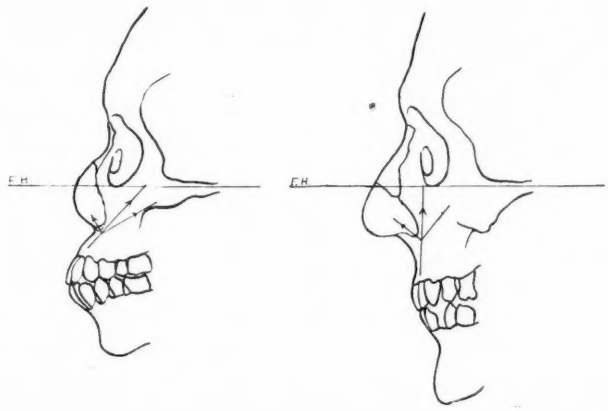


Fig. 3. Diagram contrasting the survival of a very primitive type of face in a modern human being (aboriginal Australian) with a highly specialized type to illustrate the association of defective development of the chin with the flattening and retraction of the upper part of the face in contrast to the prominent chin and prominent nose of the European type. (After A. N. Burkitt and G. S. Lightoller.)

as a sign that man is destined to lose that tooth in the near future. In Peking man, supposed by some paleontologists to have lived as many as a million years ago, the third molar was smaller than the others. The same condition was not uncommon in apes and monkeys, as Professor Mijsberg has shown. It is, in fact, a tendency which the whole order of primates inherited, but there is no just reason for assuming that either the third molar or the second incisor is about to disappear in man in the near future. Nor does there seem to be any justification for the belief that dental troubles, such as crowding and displacement of teeth and the consequential difficulties, are due to evolutionary changes that are now active. There is no evidence that, apart from the results of racial mixture, any detectable changes are taking place in the jaws and teeth. The same irregularities and deficiencies in the teeth were occurring fifty centuries ago. Contrasts in the form and proportion of the jaws were just as marked. Civilization can not be held responsible for these things except in so far as it promoted a freer intercourse among people of different antecedents and so conduced to racial admixture and the conflicting tendencies in jaw and tooth development.

Evolution works with exceeding slowness, and there does not seem to be any certain evidence that any effects that can be attributed to recent evolution have yet been detected in modern man's jaws and teeth. In the process of admixture of peoples of different strains it must happen that, as the rigid and unalterable forms of the enamel caps of the teeth have to be lodged in the more plastic bone, disharmonies in the inherited proportions are certain to emerge, even if the jaw is endowed with wide powers of adaptation to exceptional conditions.

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ORTHODONTIC DIAGNOSIS*

GEORGE W. GRIEVE, D.D.S., TORONTO, CANADA

THE successful correction of any anomaly depends, primarily, upon an accurate diagnosis. In the field of internal medicine, due to the innumerable physical disabilities presenting, a complete understanding of every derangement is not always possible. In orthodontia, as a result of more or less failure in many cases, there seems to be a feeling that the problem of diagnosis in this branch of medical science is also a difficult one. There are, no doubt, many etiologic factors and growth processes which are not yet understood, but it is quite possible that the problem is not so complicated as many believe. The wide differences of opinion of prominent orthodontists upon the subject of etiology has made it impossible so far even to arrive at a standard classification of the different types of malocclusion. Every plan presented has apparently been defective, if one may judge from the criticism of those who have given the subject considerable study.

The classification introduced by the late Dr. Edward H. Angle[1] was the first to bring any semblance of order out of chaos. It was based, practically, upon the mesiodistal relations of the first permanent molars, Dr. Angle's theory being that these teeth were "by far the most constant in taking their normal positions," and such importance was placed upon the maxillary first molars that he designated them the "keys to occlusion." Upon this hypothesis he divided all cases into three distinct classes—I, II and III. While many orthodontists have realized that this classification had its weak points, it is doubtful whether it has yet been improved upon. In his Division 1 of Class II Angle says, in his book: "Not only are all of the mandibular teeth effectually locked in distal occlusion in these cases, but the mandible is also distal in its relation to the maxilla and usually smaller than normal." Drs. Dewey, Hellman and others, I believe, are still of the opinion that in most, if not all, of these cases the mandible lacks its normal forward growth, and while for a time this was also my own view, it is not today. I do not know whether Dr. Angle ever changed his opinion upon this point or not. There are many instances where I believe the mandible is short, but in the majority of Class II cases, of both divisions, in my opinion, the abnormal mesiodistal relation is chiefly due to a forward drift of the maxillary teeth.

The classification introduced by Dr. B. E. Lischer[2] was also faulty in that it, too, was based upon the anteroposterior relations of the maxillary and mandibular teeth. In his scheme he placed outside of the classification those cases where there was overdevelopment of the jaws, macrognathism, and underdevelopment of the jaws, micrognathism. In one of his papers, Lischer[3] said: "Distoclusion is a dentofacial deformity characterized by a distal, or posterior,

*A paper presented before the Second International Orthodontic Congress, London, July, 1931.

relation of the mandibular dental arch to the maxillary dental arch, but without extreme malformations of the jaws." Dr. Lischer described a condition in which he claims the teeth occupy a distal position in the mandible as constituting a "true distoclusion." *It is my opinion* (and this is the chief point which it is desired to bring out in this paper) *that such a condition does not exist,* and I believe that it is this almost universal error which has been responsible for the difficulty in establishing orthodontia upon a scientific basis. With the elimination of this misconception, there should be no difficulty in building up a standard classification, based upon the relation of the maxillary bones and the mandible to the cranium—not the position of the teeth in these bones, which latter is only a symptom.

The latest attempt at a solution of this vexed problem is that presented by Dr. Paul W. Simon[4] in his *Fundamental Principles of a Systematic Diagnosis of Dental Anomalies.* Simon's is a three-dimensional system, with the Frankfort horizontal plane of the anthropologists as its basis. To this plane and the median plane Simon added a third—the orbital plane. This is the most elaborate system yet presented, and was probably, at the time of its introduction, the nearest approach to a scientific effort at relative location of the denture to the cranium. As this is the most important factor entering into the diagnosis and classification of malocclusion, considerable credit is due Simon for his work. However, Simon's plan also has its critics, more particularly in regard to the orbital plane suggested by himself. If this orbital plane could be depended upon as a definite vertical line, it would be of great value in locating the anteroposterior relation of the denture to the cranium. Of the three planes, the vertical and the median are, in my opinion, the most important. If we could be sure in establishing a reliable horizontal plane, there would be no difficulty in locating the vertical one, because the latter must lie at a right angle to the former. However, I believe that a useful and sufficiently accurate vertical plane can be obtained in a more simple manner than that of Simon, and it will be discussed later when I describe my own method of locating the relation of the denture to the cranium and the face.

In full realization of my own scientific inaptitude, it is not my intention to enter into a detailed criticism of any of the plans of classification, or to offer at present any suggestion for the grouping of the various types, but merely to call attention to certain apparent incongruities in some of the most outstanding systems.

When reading orthodontic literature one is impressed by the large amount of material that has become obsolete in the light of more mature study and experience. During progress in the establishment of any line of work upon a scientific basis, those associated with its development must naturally, more or less, change their views concerning certain points, as theories are either abandoned or become recognized scientific facts. Upon this hypothesis, it would seem that Simon's scathing criticism of the late Dr. Angle's theory of the "relative constancy of the first permanent molars," and his classification based thereon, doubtless missed its mark, as the following quotation from perhaps the last published paper[5] of Dr. Angle would indicate that his views upon this point

had materially changed: "You all know that in addition to the usual irregular cusp relationships, there is found in a very large percentage of cases of malocclusion a more or less abnormal tipping or leaning forward of many or all of the teeth on either or both sides of one or both dental arches, and often, also, a slight bodily drifting forward of their normal positions. These conditions may, of course, be found in cases of all classes, divisions and subdivisions of malocclusion of the teeth."

Dr. Axel F. Lundström in his paper,[6] "Malocclusion of the Teeth Regarded as a Problem in Connection With the Apical Base," published in Sweden in 1923, and in America in 1925, supplied food for thought when he called attention to the number of failures in orthodontic treatment as a result of efforts to enlarge the apical base. His opinion at that time is epitomized in the following quotation from his paper: "When the apical base is normal, and only then, is a normal position and a normal occlusion of the teeth possible." My own opinion on this point will be discussed later.

The late Dr. Calvin S. Case[7] advocated the removal of maxillary premolars in cases of decided maxillary protrusion, on the ground that he believed the disturbance of the established, though abnormal, anteroposterior locking of the buccal teeth was responsible for the subsequent crowding of the mandibular incisors which so often results after the use of intermaxillary elastics. We all know, to our sorrow, of the many cases of Class II (Angle) which lapsed, more or less, when treated by the usual methods, employing intermaxillary elastics. Why the majority of orthodontists have continued so long to apply this faulty method, in the face of so much failure, is almost beyond comprehension.

Let us now consider treatment of malocclusion, based upon the generally recognized principles of diagnosis and the various plans of classification. With the exception of the introduction, since 1910, of bodily moving appliances and exercises for the development of contiguous muscles, there has been practically no improvement in the general principles employed by many operators during the last thirty or more years. In fact many men are still following the same methods and using the same or very similar appliances that were in vogue when Dr. Angle introduced his classification. The employment by some orthodontists of the newer appliances, such as Angle's pin appliance, ribbon arch, and his new mechanism—the edgewise arch, all bodily moving appliances, has raised the standard of treatment very much, because better control is obtained than is possible with the old labial expansion arch or the lingual wire.

In order that there shall be no misunderstanding, let me say here that I believe the lingual wire has its place in orthodontic mechanism, but that it does not fulfill the broad requirements which its sponsors have claimed for it. It is very often applied in places where its use is contraindicated, and if the operator had a clear knowledge of the tooth movement necessary, the inefficiency of this appliance would be evident. Its inconspicuousness, simplicity and ease of construction certainly commend it, but the field for its application is very limited. The use of intermaxillary elastics, in conjunction with a lingual wire upon the mandibular teeth, is, in my belief, absolutely wrong, and has been responsible for failure in many cases belonging to Angle's Class II.

Before we pass from the consideration of the lingual wire, which has found so much favor among orthodontists, I wish to quote a few statements made by its chief sponsor, Dr. John Mershon, in a paper[8] read before the Dental Society of the State of New York, in May, 1930: "Simply moving teeth to their supposed normal places is not all of orthodontia. One cannot continually work against Nature's plan of development and hope to succeed. What may appear to be progress is a mirage and the inevitable disillusionment comes, whether early or late." From this statement one would infer that Dr. Mershon realizes the large amount of effort being expended without a definite plan in the minds of the operators as to the proper course to pursue in order to accomplish the desired result. Under the side heading *Practice of Orthodontia,* he says: "It is the application of the force exerted by the machine which is very largely supposed to constitute all orthodontic treatment, whereas the problems such as when to start, how much or how little pressure, when and where to apply it, how long to continue it, and when to stop it (and these vary with every case and every individual—there are no two alike) make the practice of orthodontia a difficult problem." This paints a picture of the treatment of malocclusion as a science of extreme complexity, and further he says: "We have to admit that in the past orthodontic practice, to some degree, has been a rule-of-thumb procedure." That is exactly what it has been, and still is, to a large extent, chiefly due to improper analysis and the use of inefficient appliances, such as the ordinary expansion arch, the lingual wire, plates of different types, etc. And to impress his readers still further with the supposed intricacy of the science, he says: "In orthodontia there are no short cuts in practice or thought. Our results are uncertain and the methods of obtaining them are as varied as the types of malocclusion we treat." It is true there are no short cuts, but our results are not so very uncertain, or our methods of obtaining them so varied, if our knowledge of the etiology is correct and we apply proper principles and exercise skill in the manipulation of efficient appliances to bring about stimulation along proper lines. Then Dr. Mershon later makes a startling statement, when he says: "If it were possible to obtain accurate data, I believe (although I may be censured for this statement) that today there is as much harm being done by the use of orthodontic appliances as there is good." This, unfortunately, may also be true, due to the inefficiency of many operators who are endeavoring to carry on this work with very limited knowledge of its principles and without the necessary technical skill. And finally, the last paragraph but one in his paper I quote in full: "Isn't it true that in orthodontia we are looking for a panacea which will cure all orthodontic ills quickly and without much effort, while we know in our innermost souls that such a possibility does not exist? Why not believe the truth as we know it to be, that orthodontic treatment has no definite standard and no definite result? Isn't it true that we have tried to attain ideals which we know do not exist?"

What Dr. Mershon says in this last quotation, viz., "that orthodontic treatment has no definite standard and no definite result," indicates clearly the state of chaos which exists, due to a lack of understanding of what is actually wrong in the anomalies which we are endeavoring to correct.

More than ten years ago I came to practically the same conclusion expressed by Dr. Mershon in the last paragraph which I have quoted. I commenced a search for the cause, the results of which endeavor have since been published in several papers, reference to which may be found in a recent paper[9] presented before the International Association for Dental Research, at its meeting in Toronto, Canada, in March, 1930, and (by proxy) at the meeting of the European Orthodontological Society, in Zurich, Switzerland, in June, 1930.

The outstanding error, mentioned earlier in the present paper, is the almost general belief that teeth may occupy a position distal to normal in relation to the apical base. The following statement was made in my paper[10] before the Seventh International Dental Congress, in 1926: "Very rarely are the apical ends of buccal teeth too far distal in the bone, except in the maxillae in Class III." At that time it was my opinion that teeth are rarely, if ever, too far distal in relation to the bone in which they are placed in any class of malocclusion, but I did not then feel ready to make such a radical declaration. However, after further study of the problem, I am convinced that this is true, and argument in support of my opinion was presented in the paper[9] before the International Association for Dental Research.

This theory, which it is my desire to offer again for consideration, has had very mature study, and has been applied in practice with such gratifying results for several years that I am constrained now to hope that it might soon be transferred from the realm of conjecture to that of established fact.

If any one will take the trouble to go carefully over the papers which it has been my privilege to present during the last ten years, it will become evident that in these papers there has been shown a progressive development, based upon the hypothesis that teeth are rarely, if ever, too far distal in relation to what Lundström has called the "apical base," and that my opinion has changed during that period only in the matter of differential diagnosis as to what percentage of cases presented a short mandible and what number should be classed as maxillary protrusions, with mandible normal. The main argument has not altered, viz., that teeth are not distal to normal in relation to the apical base in any type of malocclusion, and consequently must not have stimulation applied to carry them forward except in that type belonging to Class III (Angle), which latter group is entirely different from all the rest. It is my claim, however, that even in these cases, although the maxillary teeth may occupy a position posterior to those of the mandible and be distal in relation to the cranium, they are not in distal relation to the apical base, but the maxillae lack normal forward growth and are, consequently, distal to normal in relation to the cranium. The detail of treatment of this type must of necessity differ somewhat from that belonging to the other classes.

It is my belief that cases belonging to Class III stand in a group by themselves; all others, except those in Class II where the mandible is short, differ only in degree. In the group with short mandible the problem of handling the maxillary teeth is practically the same as in all other types except those of Class III. In Class III we may have any one or more of four conditions, viz., normal maxillae, a lack of full normal growth of these bones, an excessive growth of the mandible, and a forward displacement of the mandibular teeth.

Cases in Class II where there is not full normal growth of the mandible do not differ materially from others in this class and those of Class I except that the mandible has not attained its full normal growth, and that those in Class II may manifest a greater forward drift of the maxillary teeth than those in Class I. To epitomize, *with the exception of excessive growth of the mandible and lack of normal growth of both maxillae and mandible*, as mentioned in detail before, *malocclusion may be said to be the result of an abnormal forward displacement of the teeth.* If this theory is correct, then the problem of diagnosis, classification and treatment of malocclusion becomes very much simplified.

The theme running all through that excellent book[11] of J. Sim Wallace, *Variations in the Form of the Jaws*, seems to have as its basis the same theory for which I have been endeavoring for five years or more to obtain the consideration of the profession. Lundström, too, while attacking the problem in a different way, apparently holds somewhat the same view upon this point. The latest published work of Angle would indicate that this was, practically, his opinion also.

My study of Simon's work[4] leads me to the conclusion that he believes, as I do, that most of the cases belonging to Class II present a maxillary protrusion in some degree, but applies to this condition the term protraction. He, however, is of the popular opinion that in some cases the mandibular teeth may occupy a position distal to normal in relation to the apical base. In his treatment of these cases, as well as those where the mandible is short, he advocates the use of intermaxillary elastics, which method, I feel, is disastrous; in fact I am convinced that intermaxillary elastics should not be applied in the treatment of any case belonging to Class II, except under certain conditions where we resort to extraction, but that anchorage should be obtained from the occiput. Simon, in the light of the following quotations from his book[4] shows inconsistency when he advocates carrying mandibular teeth forward upon the base: "But it is a mistake to speak of the anterior growth of the denture, or to maintain that with the eruption of the molar teeth the dental arches move anteriorly. It is more accurate to speak of occipital growth, because if we compare the upper, middle and lower facial parts, we note a uniform frontal growth throughout." And further he says: "Growth seems to proceed posteriorly to accommodate the molars." Here Simon voices his belief in the same basic principle set down by Sim Wallace and myself, though he does not apply it in treatment but seeks to stimulate growth anteriorly.

In those cases where it is believed by many that the mandible is lacking in its normal forward growth, the majority of practitioners, including Simon, apply practically the same method of treatment as in that other supposed type which Lischer speaks of as constituting a "true distoclusion," viz., where the mandibular teeth are believed by them to be distal in relation to the apical base. It is my firm conviction that this almost universal use of intermaxillary elastics in the treatment of cases belonging to Class II (Angle) has been a decided detriment to the development of the science of orthodontia.

Time will not permit here the discussion of treatment, based upon what we shall call "the newer theory," so that this phase of the subject will be cov-

ered, as fully as possible, in a paper entitled "Appliance Technic in the Treatment of Malocclusion," to be presented at the eighth International Dental Congress in Paris.

Now, it might be desirable to present a few slides, in an endeavor to enable those present to visualize to some extent the points which I have tried to bring out. Notwithstanding the general belief that there are now no true types of face, there are, nevertheless, certain typal features which enable us to place our patients in more or less definite groups, and thus aid in the diagnosis of the existing malocclusion. In the inhabitants of the North American Continent, at least, there seems to be a general tendency toward a forward displacement of the teeth, this tendency being almost entirely unrestrained in the negro race. In the white race this forward drift of the teeth is most marked in those indi-

Fig. 1. Fig. 2.

viduals with heavy features, accompanied by a large oral fissure and inert muscles of the lips, as clearly demonstrated in Figs. 1 and 2. This little girl, nine years of age, gives us a very definite illustration of this type; her teeth are in normal anteroposterior relation, and widely spaced, with mandible slightly over normal size, due to an enormous tongue, fairly large oral fissure and absence of normal lip pressure. We have here demonstrated inharmony of muscular pressure. In these individuals different classes of malocclusion may present, but always with more or less forward drift of the teeth—both maxillary and mandibular.

In Figs. 3 and 4 we have another marked case of this type, with the accompanying large tongue, and, as a result of the association of abnormal respiration, a malocclusion belonging to Class II, first division, but with mandible normal. This child is ten years of age.

In Figs. 5 and 6 we have the typical mouth-breather, presenting the characteristic malocclusion belonging to the first division of Class II, with considerable maxillary protrusion and a short mandible. This patient, fourteen and

one-half years of age, has a fairly large oral fissure and decidedly inert muscles of the lips. In Fig. 7 we see the buccal aspect of the casts of this girl's teeth, and in Fig. 8 the occlusal view. Note how definitely all the teeth have tipped forward. In the treatment of this case both maxillary and mandibular teeth should be carried back, and increased length of the mandible obtained; to apply

Fig. 3. Fig. 4.

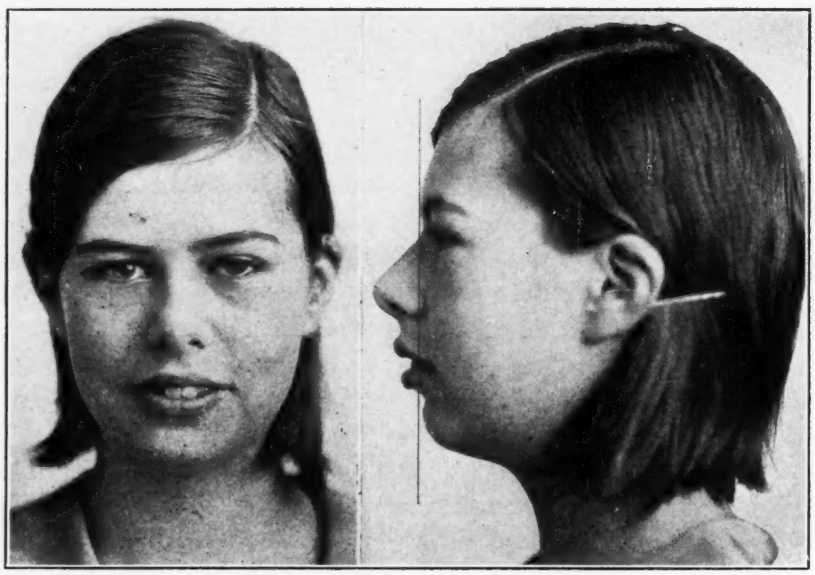

Fig. 5. Fig. 6.

intermaxillary elastics here would be disastrous, and to correct the malocclusion satisfactorily without extraction in both arches would probably be impossible.

The line shown upon the profile photographs is my interpretation of the vertical plane, the location of which is established by a study of the patient, the profile photograph and the casts. You will notice that in the case where

the mandible is larger than normal (Fig. 2) the mentum extends forward of this line; in that where it is normal (Fig. 4) the mentum just touches the line, and in the case where the mandible is short (Fig. 6) the mentum is posterior to the line.

In Fig. 9 we have a classic representative of a fairly distinctive type—the Gibson girl, the original representative of which group may be seen in the moon. In this type my hypothetical vertical line falls, more or less, posteriorly to the anterior border of the mentum, its relation to the mentum varying accord-

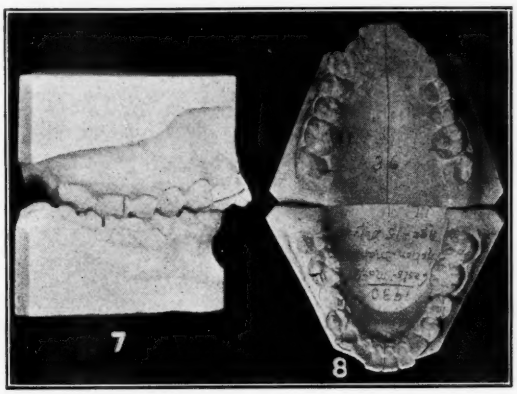

Fig. 9.

Fig. 10.

ing to the prominence of the mental eminence, which latter is a distinctive feature of this type. This girl, twelve years of age, presents a malocclusion belonging to Class I, with a tendency toward the first division of Class II. In these faces, if the teeth are standing true upon the apical base, we have the appearance of a lack of normal fullness in the dental and alveolar regions which is not real, but only apparent, due to the prominence of the mental eminence. This point we shall endeavor to illustrate in the next two figures. In Fig. 10 you see a natural profile, showing the *apparent* lack of fullness around the mouth. Fig. 11 represents an exact tracing of the same photograph,

except that the mental eminence has been cut off, the shadow of which may be seen. Here, with "a stroke of the pen," we have transferred this face to a different type, and exhibiting beautiful balance for that other type. The malocclusion was in Class I. I treated this girl years ago; her teeth were decidedly crowded, due to the fact that a small oral fissure and firm lips prevented the forward displacement of the incisors, although the premolars and molars had drifted forward of their normal relation to the apical base, as a result of nature's efforts to build a base large enough to accommodate all the teeth. By the recognized orthodontic procedure, which I am now criticizing so severely, I essayed to assist nature to accomplish this feat, and succeeded in establishing beautiful occlusion of the teeth, with well-shaped dental arches, but in my treatment had carried the teeth beyond the apical base, where they could not be expected to remain, and did not do so, but crowded again. Later, also,

Fig. 11.

Fig. 12.

the complication of impacted third molars had to be dealt with. Had I removed four premolars, the treatment would have been completed in half the time, and the result would, doubtless, have been very satisfactory and the third molar difficulty possibly avoided. You have all had similar experiences, so why continue to apply such faulty methods?

In Fig. 12 we have again the prominent mental eminence, but with a heavier type of features, a fairly large oral fissure, inert muscles, presenting a maxillary protrusion and a definitely short mandible, which is also shallow vertically, Class II, first division. Many of these individuals present a malocclusion of the second division of Class II. It is very doubtful, in my opinion, whether we can obtain increase in the vertical growth of the lower third of the face, where the main body of the mandible is shallow in its vertical dimension, although in many this would be very desirable if it were possible.

Fig. 13 shows a very marked maxillary protrusion in another case, girl eight years of age, with slightly prominent mental eminence, and a normal, or nearly normal, mandible for her type. Fig. 14 shows a tracing made from

the same photograph, identical in its entire outline except that the maxillary protrusion has been cut off, the shadow of which may still be seen. Notice here the wonderful balance. If we were to endeavor to correct this case by the use of intermaxillary elastics, we should be sure to produce a case of bimaxillary protrusion. This case is still under treatment, but we eventually had four premolars removed and were having a bad time until we resorted to this expedient. Where teeth have been displaced forward, they must be carried back until they are in harmony with the apical base. In marked cases this is impracticable, if not impossible, so in these we must resort to extraction and carry back only the anterior teeth.

Where the removal of teeth is indicated, the first premolars are the choice, but a sound premolar should never be sacrificed if there is a crippled molar in that region—the molar should be removed. Spaces are closed perfectly,

Fig. 13.

Fig. 14.

and all roots placed at normal angle. This is not difficult with an efficient appliance and good technic.

Some of the best balanced faces we see have not the full, loose lips so often noticed, the oral fissure is of medium size, and normal balance is thus maintained.

Thousands of boys and girls throughout the world are wearing bite plates practically every night of their lives, under instruction from orthodontists who endeavored, as well as they knew how, to correct the malocclusion of these patients by the recognized procedure. Why continue methods which have proved to be so faulty? My experience of about four or five years in the application of "the newer theory" has convinced me, as well as other men who have been associated with me, that it is possible so to correct our cases that mechanical retention is not required in any case after completion of treatment, unless normal respiration and normal function of the muscles of the lips have not been established.

Note.—For the theory of malocclusion expounded in this paper I suggested the name "the newer theory." While at the Congress in London, where the paper was presented, Dr. J. Sim Wallace very kindly presented me with an autographed copy of one of his earliest

works—"The Irregularities of the Teeth." This was published in 1904, and therein I later found that Dr. Wallace had set forth the same theory which he stressed in his book—"Variations in the Form of the Jaws," published in 1927. So it is quite evident that this theory is not new, but quite old, and I am very sorry that Dr. Wallace's earlier work did not come to my attention many years ago.

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DISCUSSION

Dr. Harry E. Kelsey, Baltimore, said that he must take one of his ten minutes to say that he had only learned today that he was to discuss this paper, so had not prepared a discussion. He had been familiar with the author's work for some time and was fairly conversant with his theories. At the outset the author had attacked the fundamental difficulties with which we are all confronted in the treatment of malocclusion, and he wanted to say that he thought Dr. Grieve had shown great courage in attacking it in the manner in which he had, but he (the speaker) thought perhaps all of us would need a greater knowledge of, and to be more familiar with, the means by which Dr. Grieve arrives at some of his conclusions before we could say whether we agreed with him or not as a whole. He, for one, was not perfectly sure how Dr. Grieve arrives at the vertical plane. It was quite easy to draw a line and say that some feature was out of harmony with that line; this had happened before. He felt too, that the method of treating two of the cases by tracing a photograph, and then removing those portions which seemed abnormal, gave the most successful results he had seen.

He also wanted to say that he knew of no one who had a higher technical skill than the author. He believed him to be absolutely honest, and that he had followed the subject with all his enthusiasm with the hope of finding a proved conclusion.

He felt that Dr. Grieve had a way of taking the matter out of nature's hands and doing the whole thing himself, without finding out what nature could do. We must find where nature is at fault, and apply the minimum of stimulation, so as to bring about the development which nature had intended for that patient.

That many of these malocclusions were simply the result of a failure on the part of the mandible and maxilla in civilized man to obtain a development sufficient to contain the thirty-two teeth which were designed in size and laid out at a much earlier age. This was something that was so true to him that it must be always taken into consideration.

He agreed with the author that extraction was sometimes absolutely necessary in order to arrive at a result which was at all creditable, and that usually we achieved a good result by doing so.

In conclusion, the speaker referred to the negro race in North America. He thought that we should look at the negro race in his native environment, although he had brought

his physiognomy with him to North America. He did not regard what we call a prognathous condition in the negro as abnormal; he had magnificent jaws and dentures, placed forward, but entirely in harmony with his racial type.

Dr. J. Sim Wallace said he need hardly say how pleased he had been to listen to Dr. Grieve and his rather bold attempt to throw over a system of orthodontics which had been doing a considerable amount of harm for the last thirty years.

Dr. Grieve had spoken about the forward drift of the teeth. He (the speaker) thought this was now generally admitted. In irregularities of the teeth Professor Brash had agreed that in general crowding and in so-called Class II cases, or postnormal occlusion, there was a drifting forward of the first molar teeth, so that there is an encroachment on what he called the deciduous dental arch. This latter is, generally speaking, large enough to accommodate all the permanent teeth, without crowding, if the first permanent molar does not move forward and encroach upon the space that should be available for the successors of the deciduous teeth.

With regard to diagnosis, Dr. Grieve has spoken merely about anatomic diagnosis. That was relatively simple. We can take models; we can see whether the teeth have tipped forward or have been pushed forward by the coming into position of the molar teeth; we can look at the face and see whether it is pleasing to look upon, or otherwise; we can see the normality of the occlusion with great simplicity; but in diagnosis the primary thing that one wants to get at is why did it come about; what was the cause of the molar teeth drifting forward, and what was the cause of the irregular position of the teeth? Why was the mandible small particularly in cases of postnormal occlusion? If we only diagnose our case anatomically, he did not think we could get much further with it. If, however, we diagnosed that something was wrong from a physiologic point of view, or that the dietetic habits of the child had been such as to preclude the possibility of a normal development of the jaws, then he thought we were getting a little closer to the type of diagnosis which was worth aiming at.

With regard to extractions, there were few orthodontic cases that he had come across which he had attempted to treat without the extraction of four teeth. There were few more terrible results than to look at the faces of some people whose jaws are abnormally small, and where the attempt had been made to produce decent results by keeping all the teeth.

One of the most unfortunate cases he had ever seen was one that had been treated for two years; by bad luck the teeth had not become carious, otherwise they would have been extracted. The lady was sent away with a face approaching that of a baboon.

Another case he would like to refer to was one in which, from necessity, he had extracted four molar teeth because of caries, associated with very considerable crowding. A year or two later he extracted four more teeth. He saw the lady not very long ago, and thought she had one of the most beautiful faces he had seen in London.

Dr. Bradley, Ottawa, wished to express his thanks for the work Dr. Grieve had done. From his statements, and from our own observations, we all knew we had a problem which required solution. We were grateful to Dr. Grieve for being bold enough to offer such a solution after careful work along these lines.

Like Dr. Kelsey, he was not ready yet to accept Dr. Grieve's solution entirely, for the simple reason that he did not know when to apply this principle. Until he could diagnose his cases he should be very careful before extracting four premolars. Until Dr. Grieve shows us results with patients he has treated who are fully grown (eighteen or twenty years old), he (the speaker) would not be prepared to adopt this method.

He regretted having results which presented that "toothy" appearance when the patient smiled, but the percentage of these cases was so small that to adopt Dr. Grieve's method would be a mistake, because we might do more harm in a greater percentage of cases than we now do in our present methods of treatment.

All, he was sure, had had many cases where the normal mesiodistal relations of the canines, premolars and molars remained after treatment, but perhaps after a few months, or years, the mandibular incisors became crowded.

While we were disappointed in those cases, he did not look upon them as complete failures if there was sufficient masticatory apparatus.

He would like to know in what percentage of cases Dr. Grieve extracted four premolars, because he may have gained the impression that he does it in a greater number of cases than perhaps he really does. He would also infer from the paper that a diagnosis can only be made in cases with permanent denture. Would these methods be applicable in mixed dentures?

He (the speaker) had found that the removal of the second molars helped considerably; it also allowed all the remaining teeth to settle quite considerably, and prevented the toothy appearance which we wish to avoid. He practiced this more and more as time went on.

Dr. Grieve speaks of moving the teeth through the mandible. He did not think this often happened. He himself believed in the development of the mandible by elastics.

He had treated cases according to Dr. Grieve's plan of treatment, with his molar planes, and found it a thoroughly good method.

Dr. Grieve, in reply, said that the manner in which each of the discussors had approached the subject would indicate that the generally recognized methods of diagnosis and treatment of malocclusion had not brought entirely satisfactory results.

Dr. Kelsey had said that "the author had attacked the *fundamental difficulties* with which we are all confronted."

Dr. Sim Wallace had said he had been pleased to listen to the author's "rather bold attempt to throw over a system of orthodontics which had been doing a considerable amount of harm for the last thirty years."

Dr. Bradley had said: "We all knew we had a problem which required solution."

In answer to Dr. Kelsey's question, in reference to the vertical plane, Dr. Grieve said that the photographer who took the photographs of his patients had a perpendicular line upon the ground glass of his camera, and for each patient he had his instructions as to what relation, in the profile pictures, the glabella and the anterior border of the mentum bore approximately to this line. After the photographs were received, the patient and the profile photograph were studied carefully, the patient being posed in the dental chair with the head placed, as nearly as could be judged, in a vertical position. By means of the vertical line which is then drawn upon the profile photograph, a record is thus made of what, in the author's opinion, was his interpretation of the vertical plane. In the paper was outlined the relation which the faces of the various types bore to this vertical plane.

Dr. Grieve stated that Dr. Kelsey's remarks about the tracings of two photographs shown seemed to be a good argument that the author had made a correct diagnosis as to the inharmony of the facial lines manifested in these two patients.

With reference to "taking the matter out of nature's hands," Dr. Grieve said that in this work the orthodontist is called upon to bring about a correction of errors which nature has made; consequently stimulation must be directed along lines directly opposite to those which have been operative, and which have been responsible for the malocclusion. If the contention of Sim Wallace and himself, as well as others, is correct, that the teeth drift forward of their normal relation to the base, then he would ask how is nature going to correct this? The great mistake which we have all been making has been that we expected nature to "right about face" and do the impossible.

Nature has been at fault in that a large enough base has not been built *at the back,* resulting in a forward displacement of the teeth, and orthodontists have been hauling the teeth still farther forward with the idea that growth would take place in front, and thus the failures.

Where the mandible is short, growth can be obtained by proper stimulation, but this growth must not be sought in the anterior portion, but at the back—in the rami. So, also, may growth be obtained in the maxilla.

Dr. Grieve was heartily in accord with Dr. Sim Wallace, and felt that his book, *Variations in the Form of the Jaws,* would, sooner or later, be recognized as one of the most outstanding contributions to the subject up to this time.

In answer to Dr. Bradley's question with reference to the results of this method of treatment, Dr. Grieve said that it requires years to obtain these, but that they were now

fast accumulating. He believed that this method of treatment was even more applicable for the older patients than for the younger ones.

Dr. Grieve stated that a definite diagnosis cannot always be made, as to the point of extractions, until the patient is old enough for the third molars to have commenced their development. If a child with a mixed denture presents a definite tendency to a malocclusion, and there is only very slight forward drift of the teeth, decision to correct without extraction would be made at once if it was apparent that nature might build a base large enough to accommodate all the tooth material. On the other hand, if the teeth were large and there was already considerable forward drift, the reverse decision would be made. However, in the latter case, some delay might be necessary in order to ascertain the presence or absence of third molars.

Dr. Grieve stated that he was now having four premolars removed in a very large percentage of cases, both in Class I and Class II (Angle), and the results were very gratifying. For seventeen years he tried to correct all cases without extraction, for he was a product of the Angle School, but he finally decided that it could not always be done successfully.

A NEW METHOD OF ANALYSIS OF DENTOFACIAL MALFORMATIONS*

DR. LUCIEN DE COSTER, BRUSSELS, BELGIUM
Professor of Orthodontia, Belgian Institute of Stomatology

DENTOFACIAL malformations must be cited as transformations of a moving medium. They must be studied by kinematic methods.

A living being is a moving medium; by no means does its evolution remain motionless. By the constant influence of moving forces, transformation of energy takes place uninterruptedly. The outer form represents the separating wall of inner and outer media. At every moment the form is the result of their interaction.

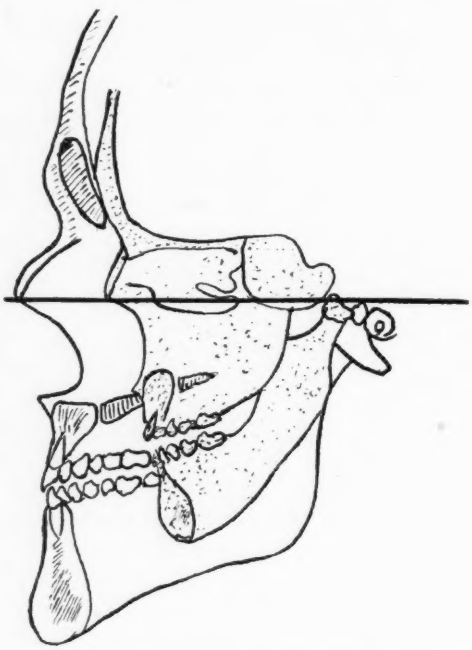


Fig. 1.—(After Keith and Campion.) Superimposition of a child's skull on the skull of an adult. The notable difference between the child's and the adult's features may thus be recorded. Growth and functional adaptation are a twofold variation and have transformed the child's face into that of the adult. It would be of great interest to know this transformation of every distinct part.

The phenomena of growth are but regular and progressive transformations of a structure continually being reconstructed.

Malformations are abnormal transformations imposed upon the natural transformatory changes.

The proper domain of orthodontic diagnosis is a question of transformatory variations.

*A paper presented at the Second International Orthodontic Congress, London, July, 1931.

Let us first discuss the process of growth increase: every point of the growing parts describes a given trajectory, but not all the points take the same direction or wander at an equal pace. The increase in dimensions is not equal over the whole surface.

Keith and Campion by the method of superimposition established the delimited paths of bone activity. The areas of bone growth may be spread over the whole surface and may occur at different times. He who deliberately ignores this unceasing transformation and its multiform proportions cannot compare a treated case with the preliminary model because he will credit himself with the improvement and the increase in growth which are due to natural processes.

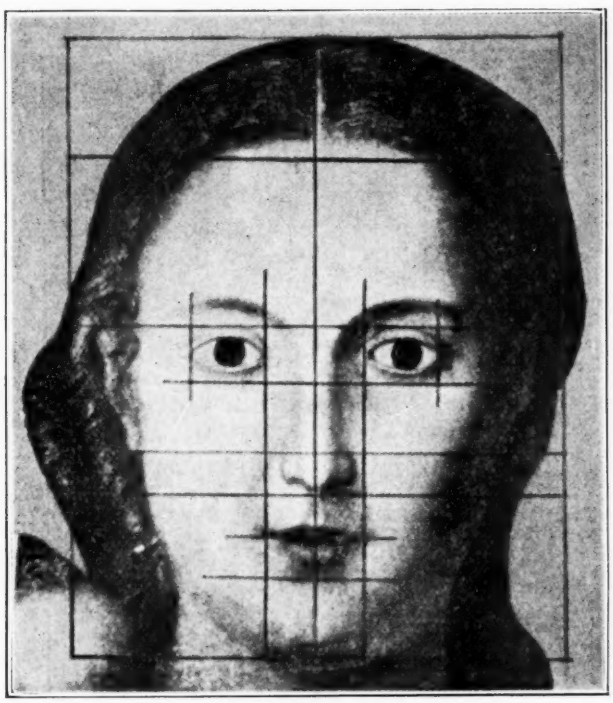


Fig. 2.—(After Bakker.) This picture represents a Madonna of Albrecht Dürer. The control lines were drawn by Dürer himself. These lines form a rectangular network on the face to show the proportion.

The second form of transformation proceeds from the never ceasing activity of functional adaptation. This transformation of adaptation likewise may present a multiple variation.

The morphologic form is at every moment the result of growth and function.

These two forms of transformation, however, are not the same, and their combination may produce various forms although within normal ranges.

Milo Hellman has clearly emphasized this fundamental conception, for the variations of normal occlusion.

An unlimited diversity characterizes the morphologic normal. Leroy Johnson says: "The limit of the normal cannot be determined with mathematical certainty, i. e., a definite line cannot be drawn between typical and atypical structures in all instances on account of the infinite degree of the variation mani-

fest in living forms, and also from the fact that the forces of evolution are continually modifying typal forms, keeping their boundaries in a state of flux." The problem of dentofacial diagnosis may be defined thus: to distinguish the anomalies of evolution from the natural and normal variations.

A second peculiarity is the fact that the diagnostic judgment must be made on unstable conditions. The change of tomorrow may change the proportions of today, and the movement of the future is dependent upon past evolution. At every moment our diagnostic procedure must be a study of evolution.

A rational diagnosis does not consider the malformation as a fixed and isolated structure, with static relations, but as an essentially variable one, modified by time and space. It is necessary to discriminate between normal and abnormal transformations. We must be able to apply the criteria of the normal to any of the variant forms. On the other hand it must be possible to consider separately the several parts, so as to divide the areas of lesion from the normally developing ones. These criteria moreover must apply to variations in time, the typical characters being dissimilar in youth and in adult age.

The morphologic diagnosis must be made by kinematic rather than by static methods. It must be lesional in order to analyze the place of every part in the general flow of evolution.

Can we find criteria of the normal which can be adapted to all normal faces in all instances?

Incontestably, there are characteristics common to all normal faces, and easily recognized at a glance. Their possession is the equivalent of normality, their absence the equivalent of abnormality. It should be a commonplace to emphasize the difference of these symptoms of the normal from race to race, and from age to age. The normal cannot be the same for the white man and the negro, for the child and the adult.

Many scientific men in the past and at the present time have been engaged in inquiring into these normal typical characteristics: Vitruvius, Michelangelo, Leonardo da Vinci, Albrecht Dürer, and nearer to us, Schadow, Quételet, Seggel, Richer, Stratz, etc., have established the rules of normal facial morphology, governing the proportions in facial lines. A common and principal peculiarity can be observed when we draw these proportion lines on a face: each of the methods divides the face into a certain number of rectangular areas, as an expression of the proportion of growth.

In our own field of observation several writers have attempted to reveal the keystone of facial harmony in regard to dental structures. Some, basing their work on the physiologic balance of dental arches and the morphologic architecture of the face, sought these rules in order to reach dental perfection. A detailed study of form, occlusion, and articulation of the dental apparatus proved the close relationship of teeth and facial forms. But the normal dental relations and the perfection of the dental system do not necessarily and solely imply facial harmony. Nevertheless, Angle's keystone of occlusion, the maxillary first molars, may be regarded as fixing an important dentofacial correlation; especially since A. Oppenheim is establishing their constant relation with the zygomatic apophysis of the maxilla. Van Loon and his followers

(Simon, Dreyfus, Schwarz) began the study of the relations of teeth with the visceral and cerebral cranium. The most famous of the laws of dentofacial correlations is Simon's orbital canine law. This although not absolutely constant, as demonstrated by anthropologic study, expresses a fixed relation, corresponding to a binomial curve of frequency between the orbital point and the canine. As another statement of correlation the lines of Dreyfus and of Izard must be mentioned. Simon's orbital line delineated the facial profile posteriorly, Dreyfus' and Izard's lines demonstrate the profile anteriorly. The conclusions of Izard's anthropologic research on the bearing of facial diameters and dental

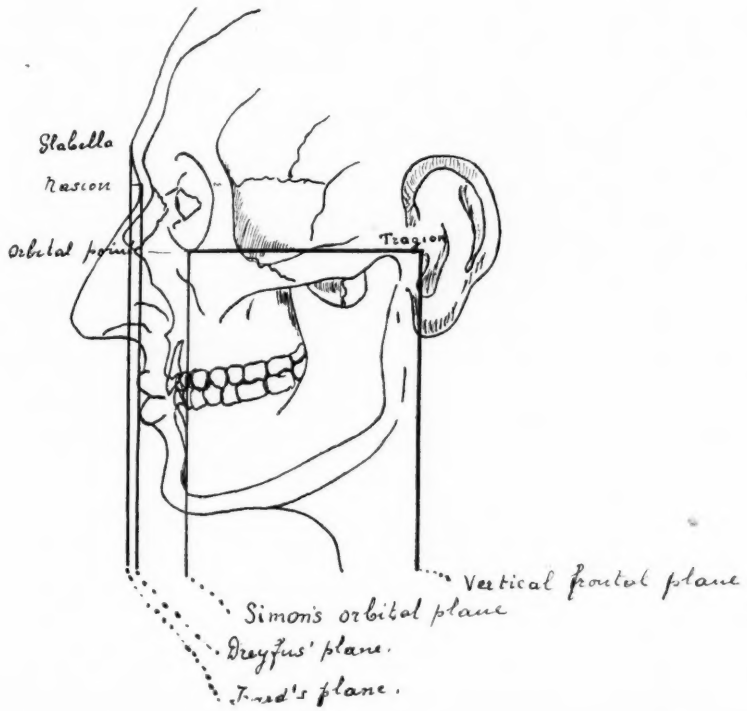


Fig. 3.—Normal face with the principal diagnostic lines in sagittal projection. These lines and also the orientation planes divide the face in a number of vertical zones. The same drawing could be used for the transverse and the horizontal projection.

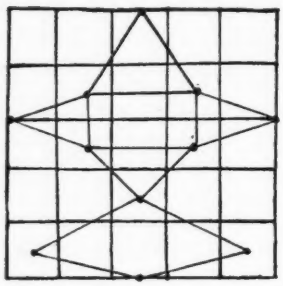
arches in sagittal and transverse directions are of the greatest importance and clearly express the proportion of facial growth.

Any one who sketches the proportions of the face using anatomic and orthodontic landmarks, must notice that these lines draw on the face a rectangular system—a truly rectangular network. We may say that this rectangular network is the expression of the normality of the face in all cases.

Deformities mar the alignment of the lines.

According to the studies of anatomists, painters and orthodontists, facial harmony is a question of proportion. The proportion lines drawn upon the face as a rectangular network are an expression of generally accepted normal facial proportion.

On the one hand, we have demonstrated that the facial growth is really a



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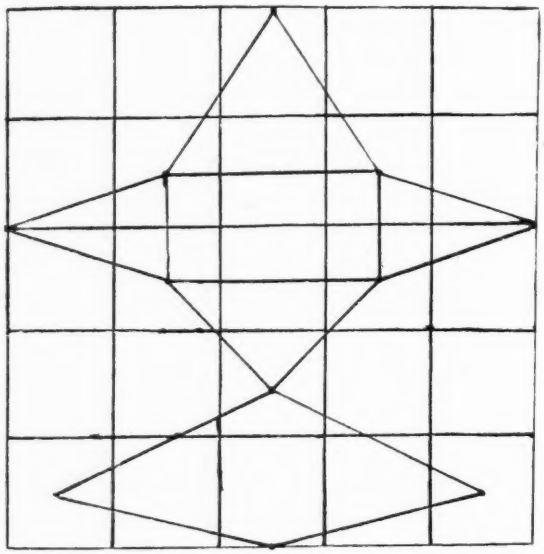

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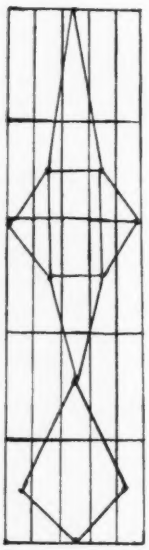

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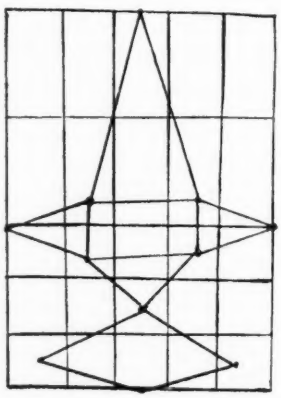
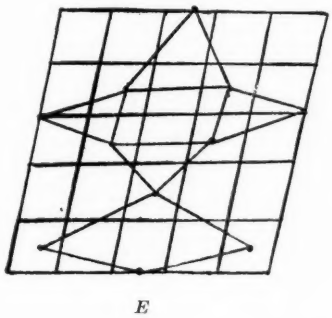


D

Fig. 4.

transformation of forms. On the other hand, a rectangular network may be considered as a synopsis of normal conditions. Transformation of forms can be studied by such graphic methods as are used generally in geometry and are called anamorphosis. This method permits us to analyze the mechanism of transition from one form to another. It is generally used in decorative drawing methods for analyzing and testing the changes of scales and the modality of transformation of figures.

To make the matter clear: let us take a sheet of rubber and draw on it a rectangular system of coordinated lines. When we apply a force of extension to each end of the sheet and deform the sheet, the rectangular system of meshes will be deformed in the same way. Irregular traction will produce an irregular deformity both of sheet and of meshes.



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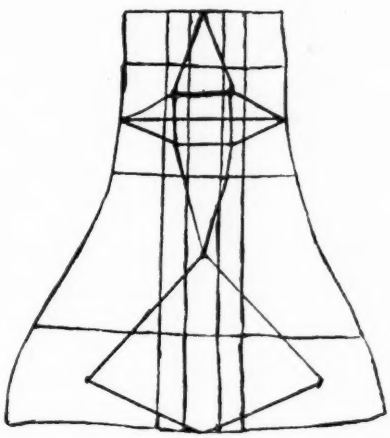


F

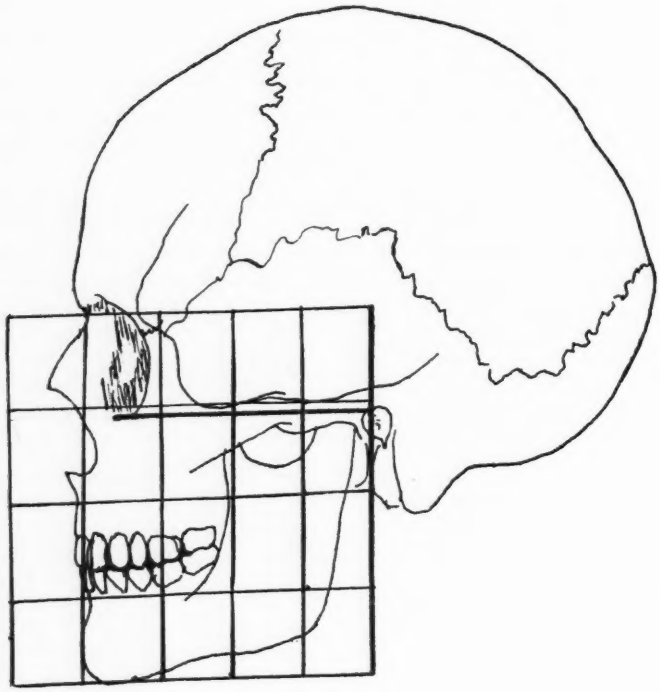
Fig. 4.—A rubber sheet with a drawing on it (*A*) is uniformly enlarged and the rectangular network drawn upon it is also enlarged (*B*). In *C* the sheet is undergoing a positive traction in the length and a negative traction in the breadth. In *D* the force in direction of breadth is nil; while the traction in the length deforms only the upper half. In *E* an oblique force deforms the sheet. In *F* the forces of deformation are irregular in direction and also in intensity and point of impact.

In all these cases we can see that the lines of the network follow the variations of the deforming forces. The appearance of various meshes, compared with the initial network, shows all the variations of the deforming forces.

As a second experiment let us take another sheet with a drawing and a rectangular network upon it. A second sheet with the same drawing becomes permanently deformed. In order to analyze the mechanism of deformation we can simply compare the deformed drawing with the normal one, but it will be easier to compare the rectangular network of the normal case with the distortion of the coordinate lines of the abnormal case. As we do not have a network on our second sheet, we must recompose the meshes in the form which they should have acquired by deformation.

The distortion of the lines indicates the deformity for every part of the drawing.

The mesh method can show every kind of deformity of figures, provided that the referred form is homologous with the deformed one, and both may be considered as proceeding one from another. This simpler method has been appropriated in the study of crystals and also in paleontology by G. Heilmann and



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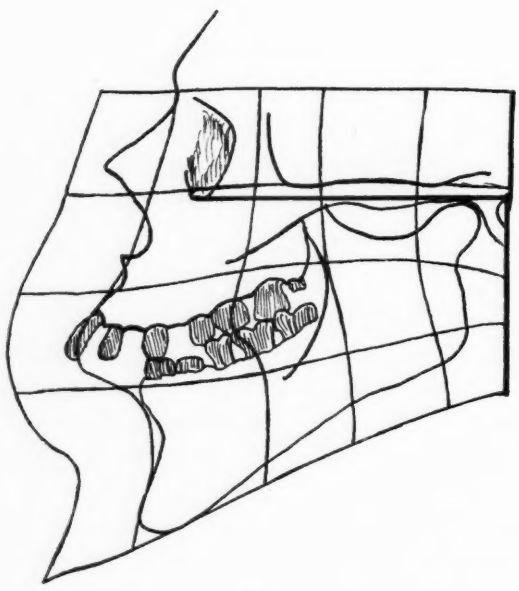


B

Fig. 5.—*A*, Normal skull orientated on the horizontal Frankfort plane and the vertical bitragial plane. A rectangular system of coordinate lines divides the face in a number of quadrangular parts.

B, Class II case with the same system of coordinate lines. Each area limited by the vertical and the horizontal lines is the equivalent of the corresponding area in a normal skull. We can note the general course of the lines on the deformation of each part.

d'Arcy Thompson. The first has analyzed by the mesh method the phylogenesis of extinct fossil animals and their relation to the existing ones.

APPLICATION OF ORTHODONTIC DIAGNOSIS

Dentofacial malformations may be considered as changes of normal conditions. Theoretically, one could pursue from stage to stage the trajectory of each point of facial and dental features and return to the initial normal conditions. We could compare the initial normal with the intermediate steps and by degrees arrive at the present status. Unfortunately this manner of working seems impracticable.

Instead of comparing the anomalous form with the normal form from which it is derived, we can ignore the time factor and suppose that the malformation was an accident, a revolution in the conditions of actual normal features. Actually, a number of facial points do break out of the normal range, forcing away in every direction the lines of normal rectangular network taken on. We have already demonstrated the constant presence in normal cases of a rectangular system of proportion lines. A system of coordinate lines at right angles in vertical and horizontal direction will frame and unite the proportions of all anatomic points. The disorganization of the rectangular network will record and delimit the anomaly. A similar operation, as on the rubber sheet, will permit us to analyze this sudden disarrangement of lines. Our reference diagram will be the typical diagram of the normal, but it is only used to apply upon it a rectangular network and to record the connections of the lines with the anatomic points. Logically, this normal type will present all normal conditions and also a perfect rectangular arrangement of coordinate lines. The changes of scale do not alter these orthogonal dispositions, and for all types of faces the straight lines will cross at right angles.

ADVANTAGES OF THE MESH METHOD

1. It permits us to obtain information regarding the transformation of homologous parts of the animal morphology by the distortion of coordinate lines.

2. It permits a more synthetic view of the intimate mechanism of the two kinds of lines, than by simple inspection.

3 The drawing of meshes forms a real superimposition of parts; actually it is an anatomic pathologic dissection, permitting us to limit and recognize the lesions and to study each of these from different points of view.

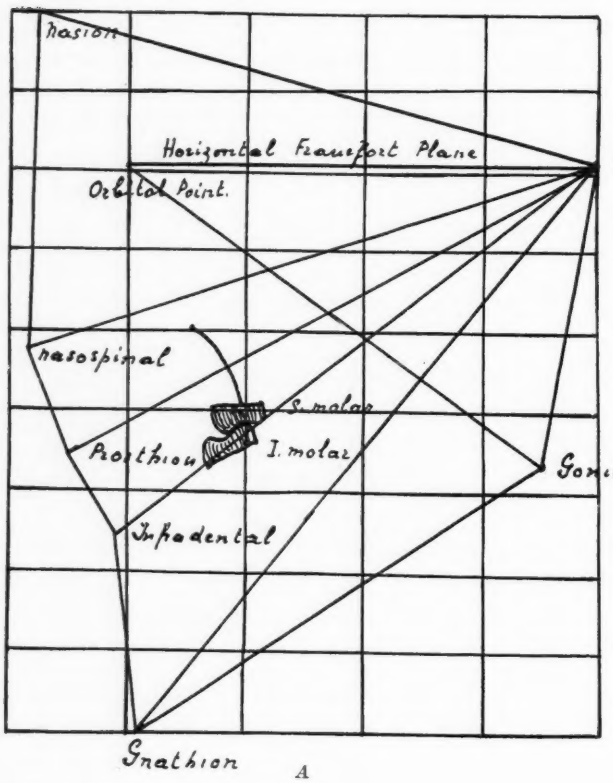
4. The drawing of three diagrams in the three directions of space permits a stereographic view of the transformation.

5. It takes no account of the normal variations of objects or their absolute value.

GENERAL TECHNIC

Making meshes is a general method of analysis, and all sorts of reproduction of objects may be used for it. All photographic, radiographic, or graphic methods could be utilized, provided only that we have a normal typical diagram with the mesh work placed on it.

On a second diagram the coordinate lines are drawn in such a way that the



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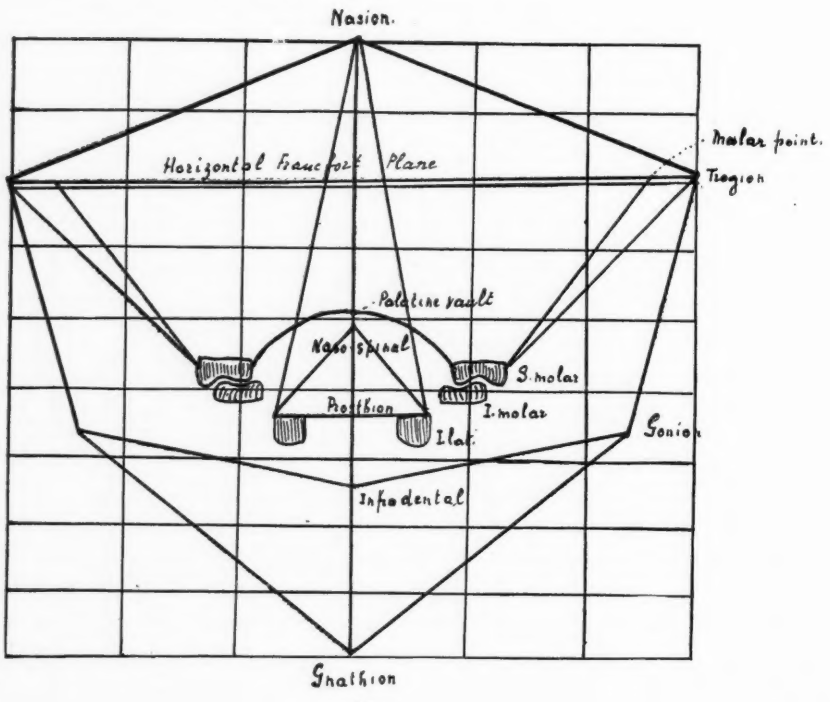


B

Fig. 6.—General types of normal diagrams for adults.

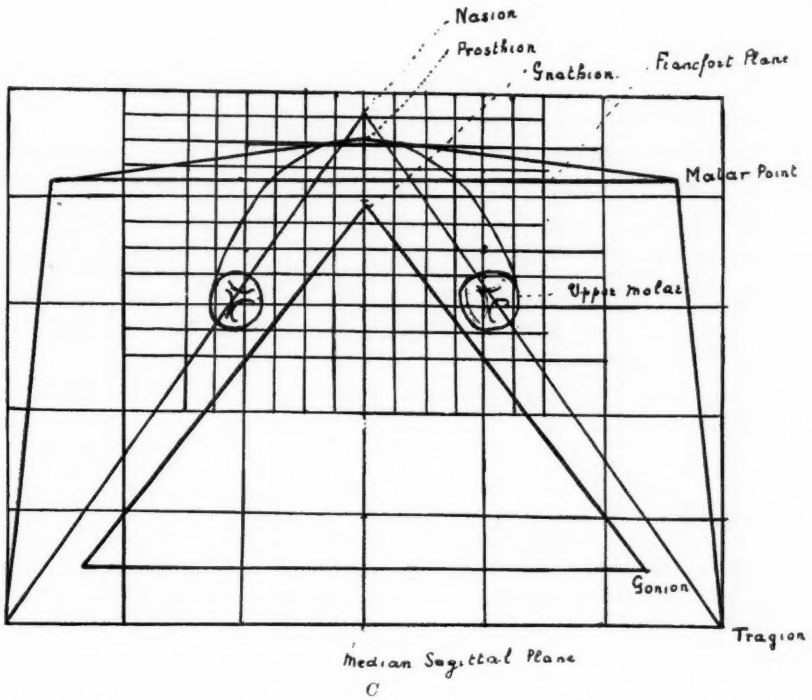
A, Sagittal diagram projecting the anatomic points on the median sagittal plane, orientated on the Frankfort plane. The only criterion of normality is the rectangular arrangement of the coordinate lines. Neither changes of scale nor normal variations can alter this criterion.

B, Frontal vertical diagram projecting the points on a vertical frontal bitragial plane. The median sagittal plane is the plane of symmetry.

anatomic points assume the same relative position in their respective mesh as in the normal network.

SPECIAL TECHNICS

In adapting mesh methods for orthodontic diagnosis we are preserving possibly all established technics. So we are presenting the case as cephalometric



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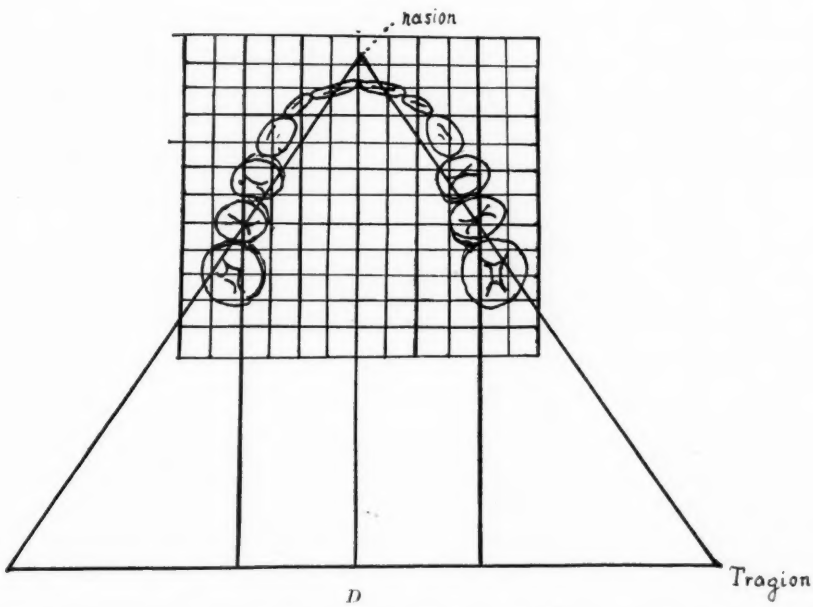


D

Fig. 6, Cont'd.—*C*, Horizontal diagram projecting the points on the Frankfort plane. A supplementary network was applied in the region of the arches.

D, For detailed analysis of a single arch, a supplementary diagram can be made. In simple deformity of the arch without facial disharmony, drawing of this simpler network may be sufficient.

diagrams. The orientation planes also are adopted. According to these instructions the face must be presented in three diagrams:

1. Horizontal diagram, projecting the points of the face on the Frankfort plane.

2. Sagittal diagram, projecting all points on the median plane, passing through the nasion and the middle point of the bitragial line.

3. Frontal diagram, projecting on the bitragial plane, perpendicular to the Frankfort plane.

The orientation of the diagrams will be taken by the horizontal plane, the median sagittal plane, and the vertical frontal plane.

In order to have a detailed examination of both arches, supplementary graphs must be provided. These graphs can be applied on the horizontal diagram. The three graphic diagrams of the face must be obtained from cephalometric measurements or from projection drawings by a stereograph. Actually, I prefer the stereographic projection to the former technic of developing the surfaces. Those who do not use a stereograph can also project these measures with a simple pair of calipers.

I shall not describe the technic of measuring and projecting, as they are, to my mind, of little importance in this method.

NORMAL DIAGRAMS AND NORMAL MESHES

It is a matter of evidence that preliminary research should have fixed the normal type, possessing all the characteristics of normality.

These normal types should evidently vary from age to age or rather by stages of growth.

We have measured more than two thousand individuals according to cephalometric methods. Among these, three hundred were found normal (all adults being soldiers). We also measured four hundred children at different ages. The values were treated according to anthropologic methods of statistics. From the normal ones a typical diagram was obtained, presenting a standard of typical normal conditions.

The same standard diagram was found for different steps of growth.

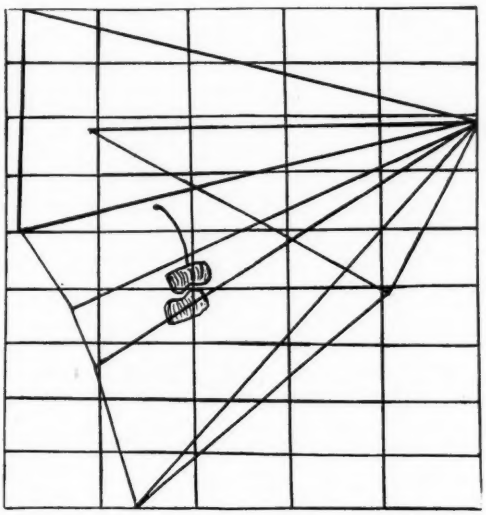
A, a diagram at four years of age;
B, a diagram at six years of age;
C, a diagram from eight to twelve years;
D, a diagram from twelve to fifteen years;
E, a diagram from fifteen to twenty years;
F, a diagram at twenty years (adult).

When we apply the same network on these diagrams, we note the various relations of anatomic points with the coordinated lines, showing the progressive changes of normal growth.

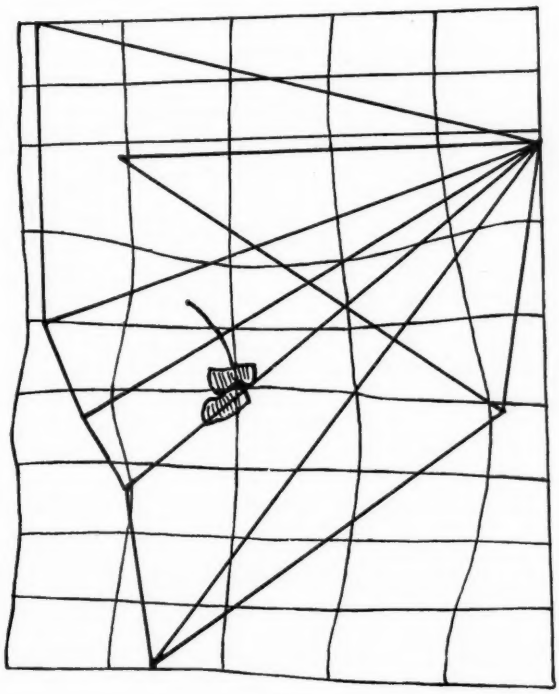
TECHNIC OF DRAWING THE COORDINATE LINES ON AN ABNORMAL DIAGRAM

Let us take the network on a sagittal diagram of a mandibular prognathism.

At first we draw the orientation lines: the Frankfort horizontal plane and the vertical frontal, i. e., the bitragial plane. The upper horizontal line of the



A



B

Fig. 7.—*A*, Normal sagittal diagram of a child six years old, with the typical network. A similar diagram on the network must be made for the different steps of growth.

B, To simplify the variation brought about by growth in typical cases, the progressive transformation of growth is schematized and analyzed by comparing the adult's with the child's morphology. We must notice the vertical increase of the nasal passage, the forward progression of the mandible and the backward growth of the mandibular angle, the acceleration of growth of the ramus, and the lowering of the gonion. We must especially note the formation of the chin.

network must pass through the nasion. Backward no one point can fix the line. We therefore sketch this line parallel to the Frankfort plane. The second passes under the horizontal eye-ear line, beneath the orbital point and the tragion. We mark this line parallel to the horizontal plane. In order to determine the exact vertical situation of this third line, we must observe its relations to the horizontal plane on the normal diagram. A distance of 1 mm. separates the third line from the horizontal. The mesh has a height of 14 mm. The second line is to be found midway between the first and the third lines. From the third to the upper there is a distance of 28 mm. The height from the first to the horizontal plane will be

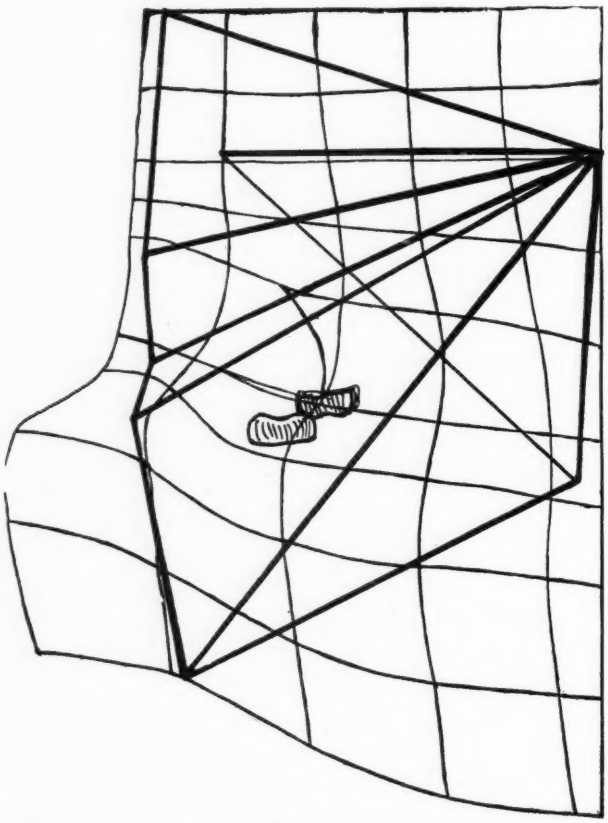


Fig. 8.—A case of mandibular prognathism. A brief inspection of the network shows the enormous distortion of the facial bones and the localized character of the malformation. A more detailed inspection of the three projective diagrams gives us a stereoscopic idea of the morphologic conditions at every level.

divided in twenty-seven parts. The twenty-seventh part is equivalent to the distance from the horizontal plane to the third line. In order to trace the second line we draw a line between the fourteenth and the fifteenth parts. Nothing fixes the fourth line, however, and it passes over the palatine vault point. Let us trace the fifth line. It passes forward through the nasospinal point and in the center under the palatine vault point. But we do not extend it backward. Then we draw the tenth line, which because of its position is fixed by the gnathion. Between the gnathion and the infradental line there are two and a half meshes. Let us divide the distance in five parts. When the infradental line stands at midheight of its respective mesh, the fifth part is a half height of mesh.

We can now draw the seventh line. Backward the gonion is situated in the lower third of its mesh. Between the gonion and the third line nothing can fix our drawing. We are justified in making these meshes all equal. Let us divide the distance between the gonion and the third line into eleven parts. The seventh line is drawn at an eleventh part of the distance beneath the gonion. We can also sketch the ending of the sixth, fifth and fourth lines. The prosthion point is to be found in the center of its mesh. The beginning of the sixth line must be drawn at the same distance from the prosthion point as is the seventh line. Further it passes immediately beneath the mandibular molar point and a fourth part of the mesh under the maxillary molar point.

The posterior terminations of the eighth, ninth, and tenth lines must be guesswork and follow the general movements of the lines above them.

VERTICAL COORDINATED LINES

The first vertical line is the orientation line, perpendicular to the Frankfort plane. It passes through the left tragion. The center of interest of the first row of meshes is the gonion point, situated in the center of its mesh. The second line is consequently fixed for this region. The third line is not fixed at all. The fourth line passes behind the palatine vault point. It is fixed neither under nor above this point. The fifth line passes just in front of and below the gnathion, near the infradental point and a little behind the orbital point.

The fifth line may be considered as generally fixed. It may be traced, the upper part by guesswork behind the orbital point, then passing at an equal distance in front of the palatine vault point, behind the infradental point and through the gnathion.

The upper inset of the sixth vertical line must be at a distance equivalent to the third part of the distance between the nasion and the fifth line. It passes in front of the nasospinal point at a sixth part of the distance between the nasospinal point and the fifth line; in front of the prosthion at an equal distance and in front of the infradental point at a distance five times the distance of the infradental from the fifth line, and continues beneath for its full breadth. The upper inset of the third and fourth lines and also of the second is easily determined. The distance between the first and the fifth line is divided in four equal parts, and the same for the under inset. The ends of the eighth, ninth and tenth lines continue the movement of the previous lines.

What is now the diagnosis of the recorded case?

In a vertical direction, we notice the inclination of the cranial base, and the vertical reduction of the nasal passage in its anterior part. The height of the upper lip is exaggerated while the vertical occlusion of the teeth is extremely closed. The palate vault is too high, as is also the vertical branch of the mandible. The alveolar process of the molar region is too low in relation to the anterior part.

For the mandible, we must note the height of the chin and of the symphysis. The whole mandible seems exaggerated in vertical development according to a reduced maxilla. In the horizontal direction we must note an anteroposterior reduction of the whole face, principally of the cranium and the maxilla. Concerning the mandible we note a forward projection of the alveolar process

and a backward projection of the body. The angle of the mandible is very sharp and hyperdeveloped. We must class this case between the classes of hyperevolutional types of mandibles in close connection with prehistoric mandibles.

CONCLUSIONS

A definite graphic method, called the mesh method, is capable of analyzing the intimate mechanism of the maxillofacial malformations. This method, beside the analysis of the morphologic profile, permits an actual discrimination of distinct parts and a definite diagnosis of the deformities. Normal variations cannot trouble nor alter its results, and cases of varying types may be compared. Cases of different ages also may be compared and juxtaposed. The mesh method is a real kinematic method.

THE PRACTICAL VALUE OF THE BIOMETRIC NORM IN ORTHODONTIA*

PROFESSOR DR. PAUL W. SIMON, BERLIN, GERMANY

BEFORE beginning to point out the manifestations of the biometric norm concept in practical orthodontia, I wish to explain what is to be understood by the biometric norm and how it originates.

The concept of a norm not only is a scientific and theoretic subtlety, but is of considerable practical value. The empirical scientific explorer, collecting natural objects, in our case individual dentures, and comparing their forms, only finds at first a tremendous difference between them. The orthodontic practitioner, however, needs to see a "normal denture," for every treatment has the object of giving the patient a similar one.

Now the question is, by what qualities can the norm of the denture be recognized?

Some of these attributes are universally known and are not to be disputed. They concern the so-called "normal occlusion," that is to say, the manner in which the two dental arches meet each other in transversal, sagittal and vertical directions. That depends essentially on anatomic conditions and only undergoes slight variations.

One might be of the opinion, and some authors hold this point of view, that this very fact represents a sufficient solution of the problem. I shall show by only one example, among many others, that this is not so. The creation of anatomically correct occlusion is, indeed, the postulate of every treatment, but the most important therapeutic questions of how to attain this aim, remain unanswered.

Imagine one of those frequent cases of mandibular distal bite. In order to achieve normal occlusion, first move all the mandibular teeth forward; second, move all the maxillary teeth backward, or do both. The resources of our technical means are well fitted for all these possibilities, but it is neither scientifically exact nor practically unimportant whether the choice of the one or the other means depends only on technical commodity or on mere accident. Even if the desired result could be obtained, there would always be a doubt whether it would last long or whether it would be sufficient in esthetic and functional respects.

Thirty years ago the great founder of modern orthodontics, Angle, was occupied with this dilemma. In a way as simple as it was ingenious he cut the Gordian knot. He established the law or dogma of the constant normal position of the maxillary first molars, created thus the famous "key of occlusion" and made possible a three-class division of occlusal anomalies, which, compared with the former chaos, has with good reason been estimated as an important advance.

Some years ago I proved in my treatise "On the Norm Concept in Ortho-

*A paper presented to the Second International Orthodontic Congress, London, 1931.

dontia'' that the law of the molar constancy is not the result of scientific research. It is on the contrary a fiction (such as was conceived by Vaihinger) established according to the requirements of practice; this fact, however, was not understood by its inventor. Its real sense becomes clearer if we say as follows: Ignoring, without being able to find out by etiologic research, where in sagittal occlusal anomalies the disturbance is localized, but needing absolutely, on the other hand, a fixed rule of treatment for therapeutics, we act as if in every case the maxillary first molars had a normal position.

It is, as Vaihinger, the philosopher of the ''As if'' has proved, the characteristic feature of such a fiction that it cannot be endorsed by scientific investigation. It cannot be verified, but it has to be justified; that is to say, its value depends on its usefulness for practical application. Its fate is to disappear as soon as a new and more useful fiction appears which enables us to work better and more comprehensively.

That is what happened to Angle's dogma of the molar constancy, which nowadays has been abandoned even by his most eager disciples, or has been changed so that it can hardly be recognized. That does not mean that anything can be said against its earlier, now historic value.

Only a few words may be added for a brief and by no means complete argument as to why Angle's principles satisfy only practical needs very insufficiently. First, only the sagittal relations are comprehended and even those incompletely. For it remains an open question in Class II whether the whole mandible has to be moved forward or only the teeth with the alveolar process. That is an important therapeutic decision. The transverse relations, manifesting themselves in the breadth of the tooth arches, as well as the vertical ones, are not taken into consideration. Especially the latter, the deviations of which produce the so-called open and deep bite, are of eminent importance for the progress and lasting success of the treatment. Even the quite elementary question of whether a group of teeth stands erect or inclined and what its position ought to be in a normal case, cannot be decided.

The new diagnostic principle qualified to replace Angle's doctrine, and conquering, as we may guess from many signs, the field more and more, takes its origin from the so-called biometric norm. What is to be understood by that concept?

We may explain it best by referring to the famous law established by Quetelet. This explorer classifying statistically the bodily size of about 25,000 North American soldiers, made the discovery that this large number of singular individual sizes, called variants, forms groups around an average value according to a certain law. The average value, that is the value of size which lies midway between the two extreme variants, shows the highest frequency.

The more the individual values differ from that average value, that is the taller or the smaller the individual soldiers are, the less is their frequency in the whole series. The result may be represented by a so-called ''binomial curve of variation,'' that is a curve both sides of which slope down equally from the average height. The average value represents the type or the norm of the character in question, in Quetelet's case the normal bodily size of the population comprehended by the examination. It may be mentioned that the large majority of all

the other bodily attributes, hitherto statistically examined, shows also the same binomial distribution of variants.

The phenomenon just briefly mentioned has to be considered as an expression of natural development tending always to produce again and again the normal type in as many individuals as possible. Consequently it may be concluded that all the attributes and qualities of this norm are of an optimal character; that means, the individuals who have this type of norm are particularly fitted for the battle of life.

These points of view transferred to orthodontics, the conclusions leading to the creation of a norm of denture, are easily to be drawn. The procedure of work too is clearly designed. The most important characteristics of a denture must be measured on as large a number of individuals as possible, and the results of the measurements must be calculated according to Quetelet's pattern. For every attribute an average value of its variations will result. The average value of all the attributes put together makes the construction of a normal denture possible. It may be added that the individuals selected for a series of examinations must belong to the same population, the typical peculiarities of form of the organisms depending on their milieu, their customs of life, etc. Furthermore, all the individuals with obvious deviations, such as loss of teeth, etc., must be excluded. The best thing would be to confine oneself to those whose dentures are faultless in every respect and, besides, show an anatomically correct occlusion.

It is obvious that the metrical classification of that material cannot be performed as easily as can be done with characters of bodily size, for the denture is a very complicated structure of irregular forms. This task, however, may be solved in a satisfactory way after suitable methods of measurement, known as gnathostatics, are established and experienced.

As for selection of attributes, an essential improvement, compared to Angle's diagnostic, may be noted. The denture is no longer considered to be merely an isolated body with an essentially sagittal extension, but is estimated as three-dimensional, and is measured correspondingly. Especially it does not seem separated from, but on the contrary, closely connected with the whole, of which it is a part, that is the head.

The normal denture constructed in that way is, and this must be fully realized, an artificial creation. It is a useful fiction, as well as Angle's molar dogma, but of a much greater usefulness which is evident at once. Now we come to the principal question of my theme.

That fictitious standard of denture, how is it to be practically applied in orthodontic diagnostics and therapeutics? Let us try at first to explain the indispensability of that norm in practice in a more general way, as follows: In no case of dental anomaly are we able to state what kind of "normal" denture the individual in question would have obtained "by nature" unless some unknown disturbance had influenced its development unfavorably. There even exists a possibility, which in many cases has become by etiologic research a probability, that even natural development undisturbed by any damage would have produced an anomaly, the germ cell having been already predestined in a hereditary sense. We therefore give to the patient, by means of our orthodontic therapeutics, that really normal denture typical of his race, and procure for him optimal condi-

tions in anatomic as well as in functional and esthetic respects. We justify our actions by the useful fiction "as if" the individual had obtained such a denture by natural development without any disturbance.

It is evident that by therapeutic procedure according to that principle, the interests of the patient as well as those of the orthodontist are best taken care of. The patient does not attach any importance merely in having the deformities caused by secondary or exogenous influences corrected, and his genotype shown. Even if that happened he might not be at all satisfied with that success, for there are hereditary anomalies. Of course such an attempt is on the whole illusory, the etiologic division into hereditary and acquired anomalies being merely fictitious and not of a real character. That is why in orthodontia—rare isolated cases being left out of the question—mere causal therapeutics usually fail.

The claim of an orthodontist, however, is an especially metrical one. General diagnostic designations such as prognathia, distal bite, progenia, open and deep bite, etc., are merely symptomatic and have a practical value only if they are comprehensible by exact metrical relations to a norm. Orthodontic therapeutics consist essentially in moving parts of the denture from one, the abnormal point, to another, the normal one; and the exact knowledge of the latter is essential to a treatment which is certain in its aim and is not of an experimental nature, the suitable means of which are to be chosen from the knowledge available.

It may be pointed out that the cephalometric diagnosis of an anomaly as a deviation from a biometric norm is free of any etiologic elements. This, at least, is a principal and strictly scientific fact. The statement of an alveolar contraction, for instance, or of a mandibular retraction, etc., does not give any explanation as to whether the development of the patient has been interfered with and whether pathologic factors of constitution or other exogenous ones had played a causal part, or play it still, or whether there is a hereditary disposition, which consequently is present in the individual. In most cases, indeed, the stated and metrically comprehended anomaly would be in accordance with the real, partly pathologic, partly genotypical processes of the organism, but an exact not hypothetic statement thereof is quite impossible and will always remain so according to our biometric understanding.

The practical realization of the fictitious standard of the denture will not be equally possible in all cases. It is characteristic of that standard as an ideal pattern that it cannot always be absolutely verified.

There is no difference, of course, between other diagnostic and therapeutic methods. The constitutional resistance, mysterious and in most cases inexplicable, has always to be overcome if it is to be overcome at all. Great therapeutic art and rich experience in knowledge of individual reactions are required so as to be able to judge and to direct correctly the process of treatment. The law of norm is the aim striven for, but often it cannot be accomplished literally but only approximately, or wholly in some and less in other attributes. Constitutional peculiarities may force one to individualize the standard, that is, to adapt it to the special claims of a case in order to get a satisfactory result. That will be the more necessary the greater the biologic resistance is, as for instance with adults.

Finally, I should like to give a practical diagnostic application,[1] choosing

from the normal characters of a denture only one, claiming a special interest, because it sets forth a direct replacement and abolishment of Angle's diagnostics, I mean of the so-called orbital canine law.

This law means that the orbital plane (the frontal one of the three skull planes) in normal cases passes approximately through the points of the canines. This fact has in the meantime been tested by some of our colleagues in about one thousand individuals, and has been absolutely proved in spite of several objections, so that it may be looked upon as certain. Practice can take great advantage thereof, of course, only as far as sagittal anomalies are concerned. We shall try to treat every case so that in the end the canines are in the orbital plane; and before beginning, one glance at the gnathostatic model and the photostatic picture tells us which parts of the jaws or which groups of teeth we have to move in order to accomplish this. The question of extraction, too, is satisfactorily solved on the basis of special indications. That question is particularly of great practical importance, and cannot, as Angle did, be looked upon as nonexistent.

The orbital canine law is, as already mentioned, only a part, a particularly important one indeed, of the biometrically established standard of denture. It demonstrates very obviously to the practitioner familiar with this matter the great usefulness of that process. The biometric norm is, and I want to state that once more, no fact of real objectivity, but a fictitious speculation, established on a strictly scientific basis, of a necessity not to be denied in practice.

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NEW IDEAS AND APPARATUS IN ORTHODONTICS*

PROFESSOR DR. EMIL HERBST, BREMEN, GERMANY

IN treating cases it is not absolutely necessary, in my opinion, to make use either of finger springs or of the usual fastenings. It is sufficient to employ as an inner arch a continuous gold wire bent somewhat after the form of a Roman "W," soldering it to the bands, see diagrams in Figs. 1, 2, 3. These diagrams, together with their legends, show all the important details and will be found self-explanatory. It is interesting to note in connection with this subject that the sum of the circumferences of the two molars to which attachment is made and the length of the inner curve from molar to molar are directly related; in other words, the greater the combined circumference of the molars, the greater the length of the inner arch. Hence, for cases where retention apparatus will be required, we can always keep a suitable stock of retainers made up in various sizes.

If the inner arch is to be used for regulating and not for retention, it is given the "W" form above mentioned, and lengthened according to requirements, see Fig. 1 *A*, the extension now acting after the manner of a finger spring. This spring may be with safety 1.2 mm. thick, but to be fashioned correctly it must be given that form which corresponds to the arch of the teeth, and further, there must be no inward or outward bends. The fundamental principle is as follows:

The spring is made to conform exactly with the shape which the new arch of the teeth is subsequently intended to take. For this purpose the model is cut up and the teeth are arranged upon it normally. (Fig. 13.)

In this new model, in which each individual tooth stands correctly, the relatively thick gold wire (1.2 mm.) already mentioned, is adapted to the arch of the teeth in such a way that when its function is fulfilled every tooth must be in its correct position. Obviously this strong wire will exert its greatest force at the beginning, and its effect will slowly slacken, so that when the regulation is complete, it no longer exerts any pressure at all. It is clearly an advantage that the greatest force should come into play at the commencement of the treatment, and the weaker during the late stages.

When inserting such an apparatus, the elasticity of the spring must be held in check (see Fig. 1 *B*); consequently it must be so compressed by means of suitable ligatures of thread or wire that it can be fixed in the mouth without difficulty, cement being used for this purpose. When the arch of the teeth has become widened, the regulating device must be removed and replaced by a second apparatus, which is attached to two other teeth, the object of this second apparatus being merely to fix the extended arch. Naturally, the arch of the teeth as regulated on the plaster model must correspond exactly with normal conditions. Hence it is essential that recourse should continually be had to

*A paper presented at the Second International Orthodontic Congress, London, July, 1931.

diagrams shown in Fig. 4, in order that the plaster teeth may be arranged in a proper normal arch. This method of regulation is particularly suitable for school dental clinics, since it is not costly and does not entail any great amount of work.

Just as in the above case, where on the plaster model each individual arch of the teeth is adjusted to a certain extent, so also when dealing with Class II,

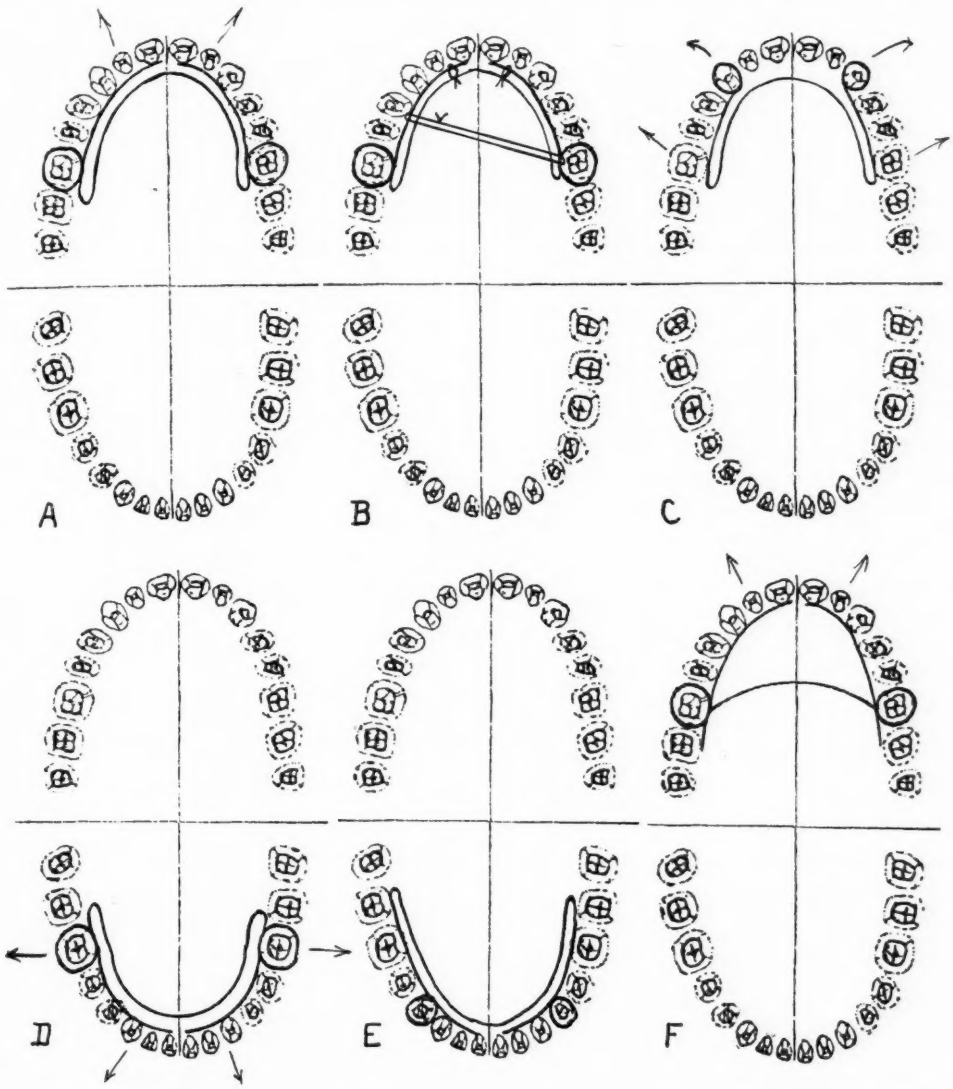


Fig. 1.—*A*, Labiobuccal expansion of the arch; *B*, arrested elasticity; *C*, labiobuccal expansion; *D*, labiobuccal expansion of the arch; *E*, labiobuccal expansion of the arch; *F*, labial expansion.

I regulate biting anomalies in a similar manner. In Fig. 5, the maxillary and mandibular arches of the teeth are shown with the above described retention apparatus fixed, and connection is established by means of an artificial maxillary articulation (occlusion hinges), see Fig. 6. By means of such hinges the mandible is invariably forced to occlude normally, whereby the maxillary articulation alters slowly but surely, so that after a year the apparatus can

be removed from the mouth without fear of relapse. We have demonstrated beyond doubt that even after the lapse of several years, a jaw which has been thus adjusted, completely retains its new position, and no injury to the teeth has ever been observed. One special advantage of this method of treatment lies in the fact that the facial appearance is immediately improved. Further, if need arises, the apparatus can at any time be slightly adjusted by the addition of small tube sections, see Fig. 7. For Class II cases, I no longer use inter-

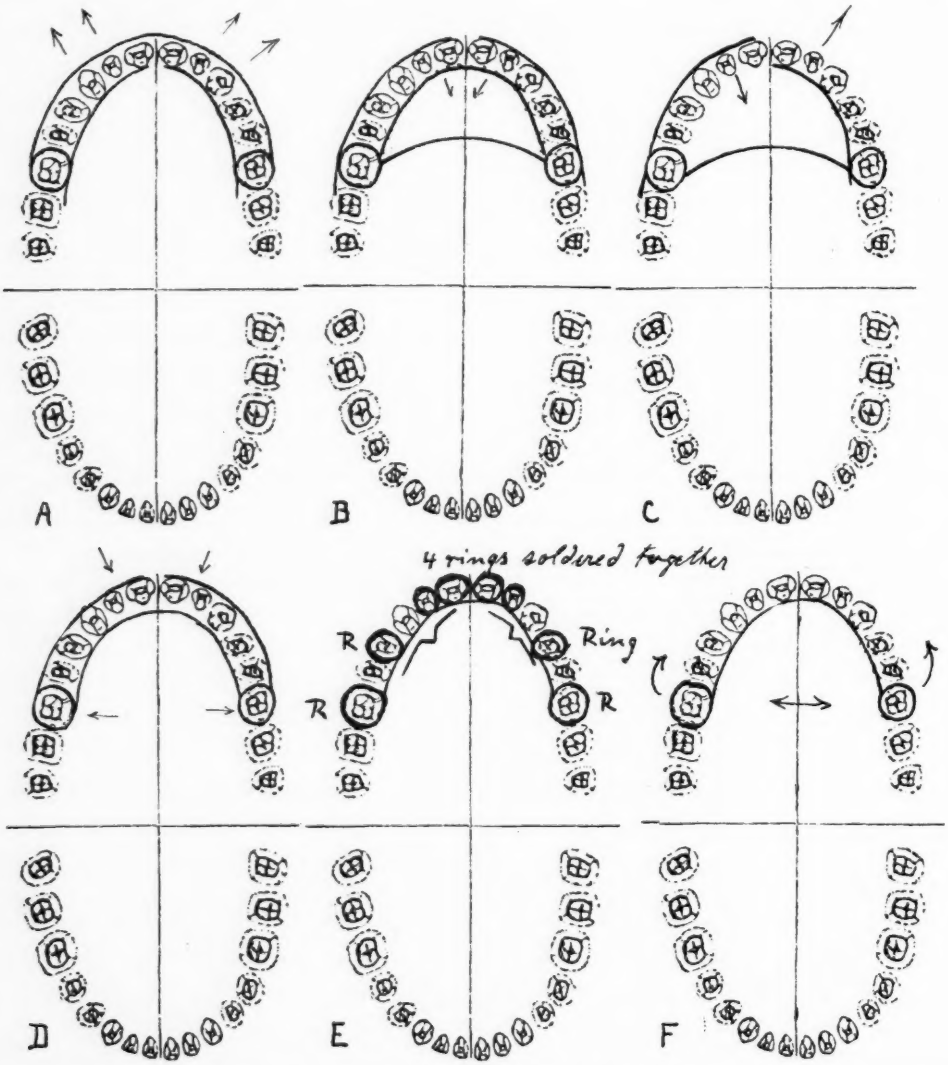


Fig. 2.—*A*, Labial expansion with automatic elimination of force; *B*, lingual contraction of the arch with automatic elimination of force; *C*, different movement on both sides of the arch; *D*, buccal expansion and lingual contraction; *E*, moving down the premaxilla; *F*, buccal movement of the first molars.

maxillary bands, as the only motive force requisite to operate occlusion hinges is that engendered by muscular action.

DIRECTIONS FOR USING THE OCCLUSION RETENTION HINGE

1. Each dental arch is regulated separately, whereby anomalous occlusion is not taken into consideration.

2. As soon as the above regulation is completed, all apparatus is removed from the mouth.

3. Models of both jaws are made from plaster casts.

4. These models are arranged one in an articulator, so that completely normal occlusion is attained. It is immaterial whether there are still spaces between the maxillary and mandibular teeth, as such are automatically rectified during the treatment.

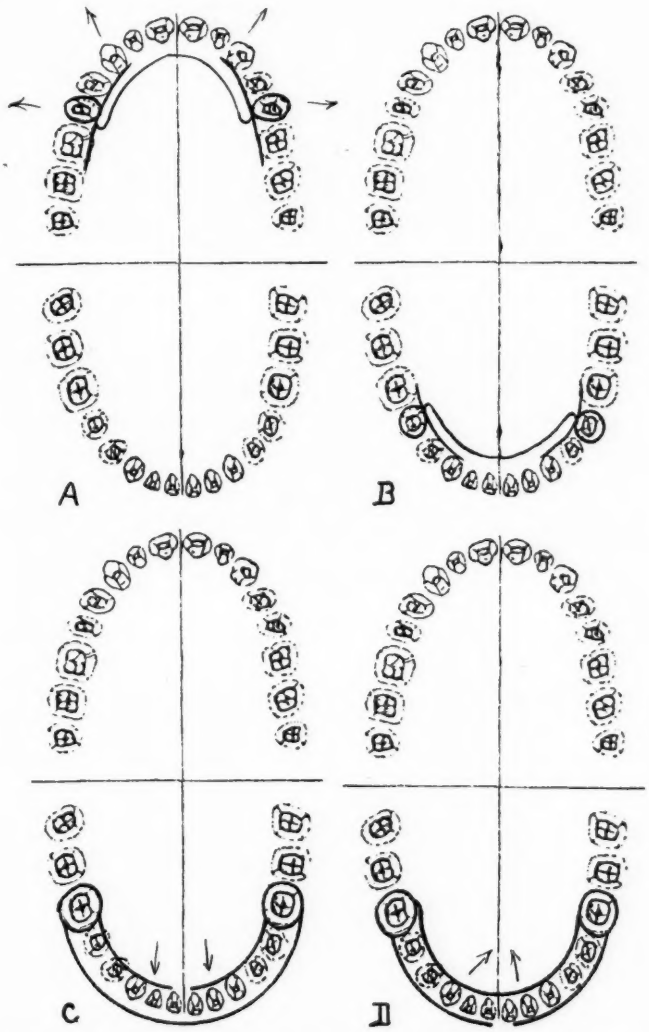
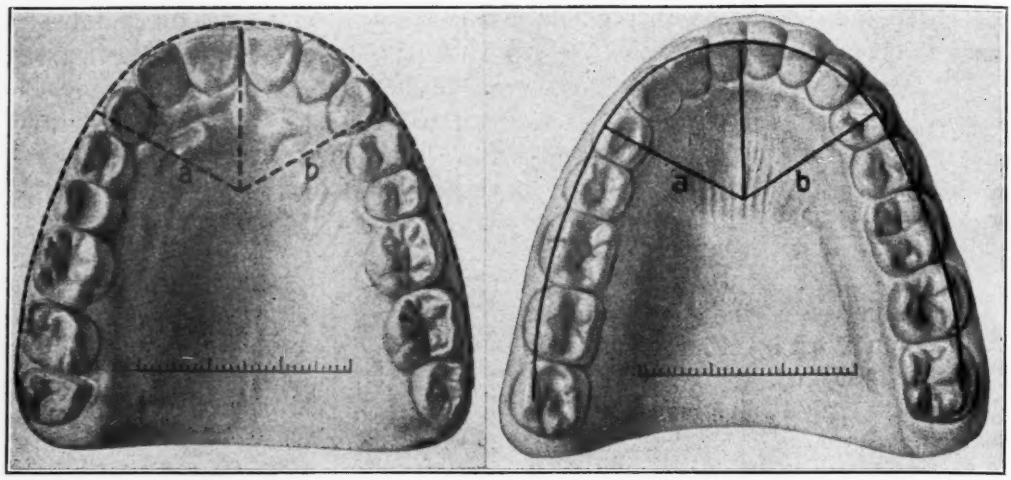


Fig. 3.—*A*, Buccal expansion from cuspid to premolar; *B*, buccal expansion from cuspid to premolar; *C*, labial movement with automatic elimination of force; *D*, lingual movement with automatic elimination of force.

5. The first maxillary molars and the first mandibular premolars are fitted with German silver or gold bands, of a thickness of 0.25 mm. These bands should be firmly mounted on the teeth before the impression is taken; by so doing a better technic is assured; since when the cast is made, they will then appear in their correct positions on the model.

6. A gold inner arch made of Aurora or Janus wire, 1.2 mm. thick, connects the bands in each jaw, and extends along the lingual side of the teeth without, however, being bent at any point.



A *B*

Fig. 4.—Diagram: *A*, normal maxillary arch; *B*, normal mandibular arch.

Fig. 5.—Maxillary and mandibular models with author's retention apparatus in position.

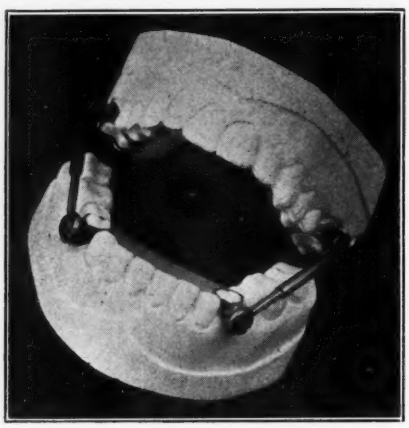


Fig. 6.—Models showing the author's occlusion hinges in position.

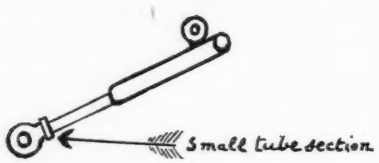


Fig. 7.—Small tube section placed in position on the pin, in order to push forward the mandible.

7. On the buccal surface of each of the bands a hollow axle is soldered, in such a manner that the bores run parallel in the maxilla and mandible; the object of this arrangement is to allow the pins and tubes to have free movement, because with any nonparallel position of the axles they would be impeded.

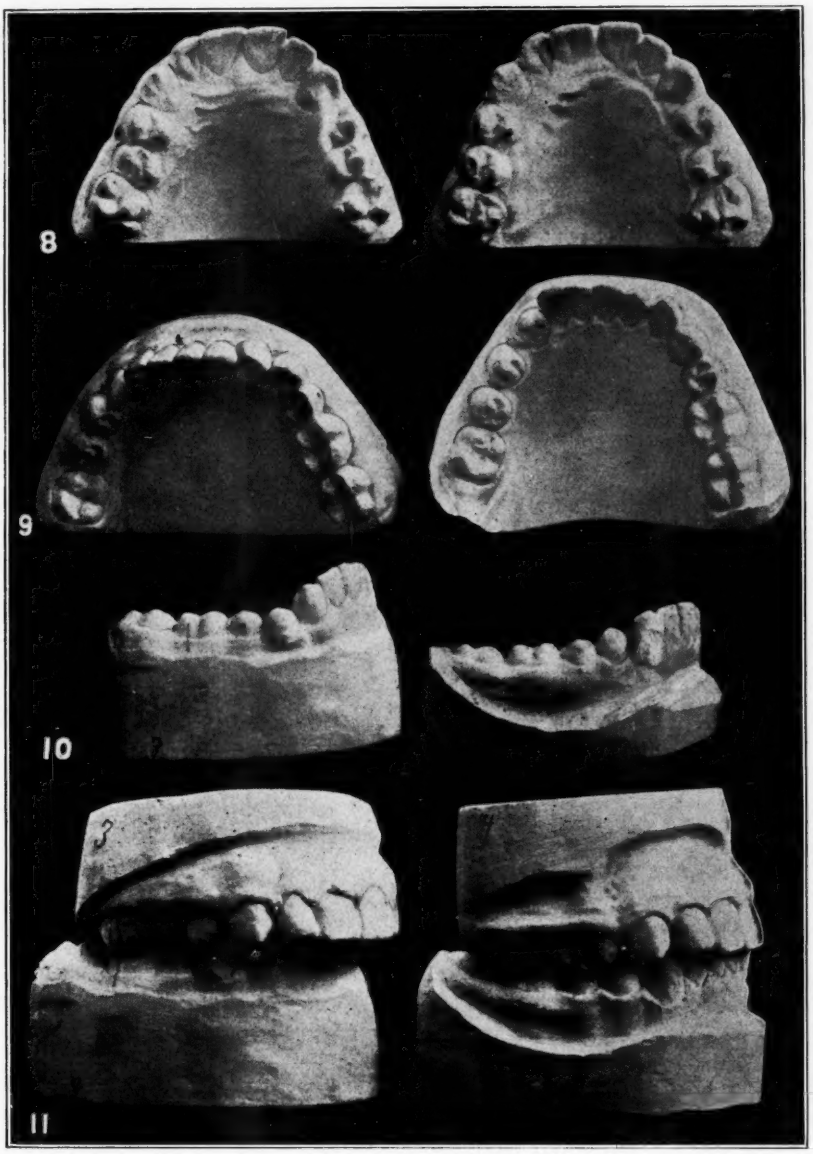


Fig. 8.—Maxilla before and after treatment.
Fig. 9.—Mandible before and after treatment.
Fig. 10.—Mandible before and after treatment.
Fig. 11.—Compensation curve before and after treatment.

8. The tubes in the maxillary appliance and the pins in the mandibular appliance are now fitted to the axles, and both parts are shortened by means of a fret saw, in such a way that when the teeth are closed the tube presses firmly on the ring-shaped end of the pin, while the pin protrudes about 1 mm.

from the tube; small screws are next fixed in the axles, in order to prevent any deviation of the pins or tubes.

9. The bite is now fixed; at every bite the mandible must occlude normally, while the joint of the jaw, the form of the jaw, and the position of the muscles, must adapt themselves to the new way of functioning. The apparatus is fastened in the mouth by means of cement.

10. After nine to twelve months, the new occlusion will have become physiologically so adapted that it will be permanent. All intermediate spaces will have disappeared, the premolars will meet exactly, and the treatment will automatically come to an end.

Hinges of occlusion are something distinctly novel. They work without any artificial motive force, being operated solely by the pressure of mastication and muscular contraction; further, their action cannot be compared with the so-called "jumping the bite." Whereas in "jumping," the mandible, when the mouth is opened, can at once spring back into its former position, with occlusion

Fig. 12.—Profile of patient before and after insertion of the retention hinge.*

hinges this can never be the case. The alteration brought about lies, therefore, mainly in the mandibular articulation.

The advantages claimed for this treatment are as follows:

1. Immediate adjustment of the position of the mandible, in relation to that of the maxilla.
2. Immediate normal occlusion.
3. Immediate improvement in facial appearance.
4. Immediate change toward normal functioning.
5. No alteration of the existing upright position of the mandibular incisors.
6. No alteration of the normal position of the mandibular premolars.
7. No alteration of the normal level of the teeth.
8. Complete automatic adjustment of both maxillary and mandibular teeth to normal occlusion.

Figs. 8 to 11 demonstrate the adaptability of the apparatus to the correction of underhung, and abnormally rising lower bite.

Fig. 8 shows the maxilla. Fig. 9 shows the mandible. Fig. 10 shows the side view of the mandible. Fig. 11 shows the occlusion. Fig. 12 shows the

*Obtainable from the Verkaufs-Centrale fuer Orthodontic A. G., Bremen.

patient both before and after the insertion of the apparatus. From these two photographs we can see that when the retention hinge is used, there follows an immediate improvement in the patient's general appearance, due to facial alteration. The actual reformation of the bones is completed in from nine to twelve months.

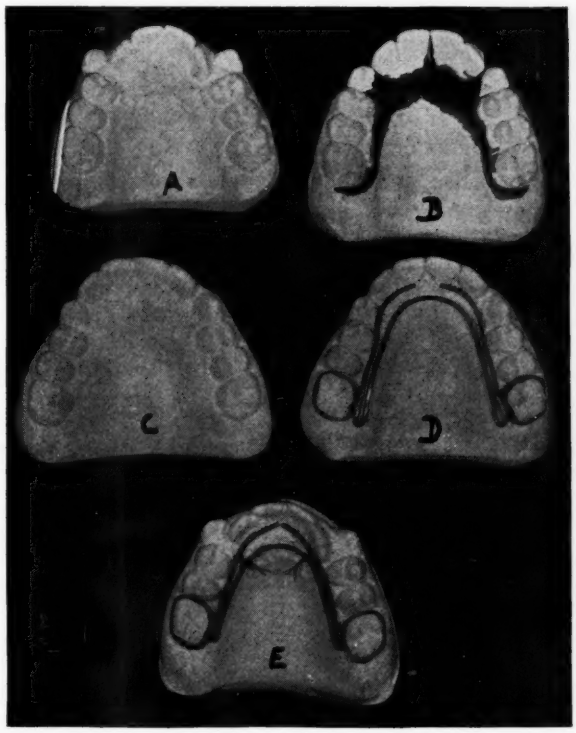


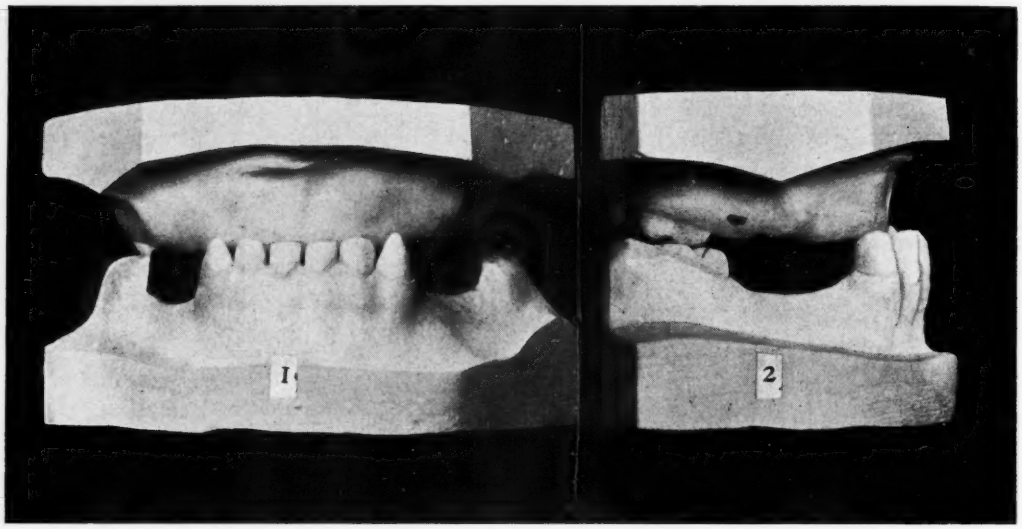
Fig. 13.—Preparation of plaster model and construction of automatic appliance. *A*, Original model; *B*, corrected model; *C*, new model reproduced from model "B"; *D*, regulating appliances adapted to model "C" before gold is tempered; *E*, tempered and compressed appliance in position on original model.

Such a case as the above need no longer be treated orthodontically, as a result can be immediately obtained through causing proper occlusion to take place in a normal manner by the aid of retention hinges, which apparatus is completely invisible when fixed in the mouth.

AN UNUSUAL CASE OF MANDIBULAR PROTRUSION (ANGLE CLASS III)*

C. L. Endicott, L.D.S., England

RECENTLY, the following case has come to my attention: a girl, six years of age, with a mandibular protrusion. About the time of her fifth birthday, that is, a year ago, all of the maxillary deciduous teeth, together with the four mandibular deciduous molars, were removed. The profile indicates a marked lack of vertical development, and a prominent lower lip. The mother states that the protrusion has developed within the last year, and after a careful study of the case, I am inclined to share this view.

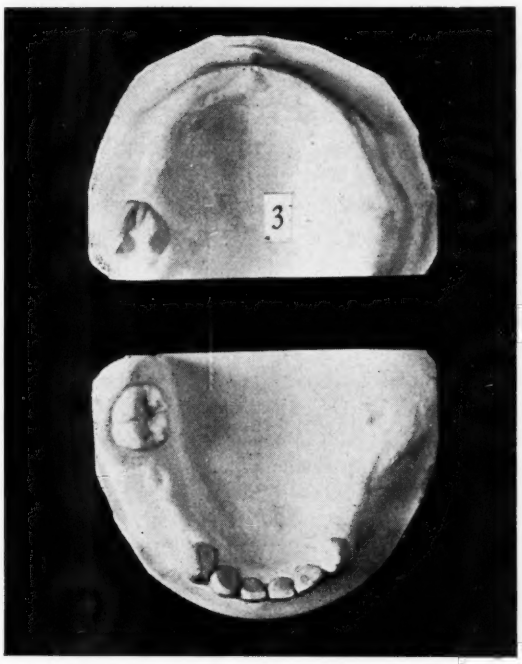


The models (Figs. 1 and 2) demonstrate the relation of the dental arches with the remaining mandibular anterior deciduous teeth biting in front of the maxillary ridge. I feel that the child has brought the mandible into this forward relation in search of a comfortable position in which to bite. It is now quite possible for the patient to retract the mandible to what would seem to be a normal mesiodistal relationship. An x-ray examination revealed the absence of both mandibular second premolars—all other teeth are present, and in the maxilla the premolars are crowded, due to the abnormal forward position of the first permanent molars. The child was breast fed, and there is a history of measles at twelve months and influenza at four years of age. A brother of three years possesses a good deciduous dentition, with normal developmental spacing of the incisors. A sister of sixteen years has a fairly normal dentition. These are the only other members of the family that I have had an opportunity of examining.

*Transactions of the British Society for the Study of Orthodontics, 1931.

This case has been under our care for but a short time. The method by which I propose to attempt its correction is as follows:

In the belief that the difficulty of overcoming this condition will increase with the length of time that it exists, and because the permanent teeth are beginning to erupt, I have decided to start at once. Temporarily, a pair of vulcanite plates with inclined planes in the premolar regions have been inserted, the inclines being articulated so as to encourage the posterior movement of the mandible. The lower planes, while sloping from behind forward and downward, slant slightly to the lingual. The upper planes slant in the opposite directions. This arrangement of the planes helps to maintain the correct median line and the lateral relationship. The bite is opened by the planes to allow the first permanent molars to erupt further, and thereby assist in the establishment of a correct



vertical relationship. The opening of the bite, now exaggerated, will be reduced as the jaw recedes and the planes pass along one another. During periodic visits the ends of the planes can be ground away as found necessary; so also the vulcanite to permit the teeth to erupt. These plates can probably be dispensed with after the first permanent molars are in occlusion. This appliance is augmented by a chin retractor and headgear joined by elastics.

In conclusion I might state that the child has been wearing the plates for a week and with no apparent discomfort. I should appreciate the opportunity of bringing this case before the society as a future casual communication in the hope that I might be able to show some improvement.

DISCUSSION

Mrs. Michaelis said that the case had been shown to members during the recent postgraduate course at the Eastman Clinic. She had been particularly interested in it then because, in the January issue of the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY

AND RADIOGRAPHY Dr. Willett had published three very interesting cases which had seemed to be almost identical with the present one. His children had all been much younger: two had been three years old, and one three years and three months; the last had been completely identical with Mr. Endicott's case. It had possessed no maxillary teeth at all and there had been six mandibular incisors. Dr. Willett had treated the three cases with complete sets of artificial dentures made by a very ingenious method, and claimed that they had been very successful. The difference between those cases and the present one, of course, was that Dr. Willett's had been more in the nature of preventive orthodontics, whereas the present child's condition had not been recognized until the failure of occlusion, which presumably must come from the loss of so many teeth, was more or less advanced. The speaker asked the lecturer whether he did not think it possible that some form of preventive orthodontics might become more or less standardized, so that children who lost the deciduous teeth early—a loss which Mr. Chapman had always insisted, and which they all knew well, was very detrimental to the formation of the denture—could have the process kept in check, so that the bad result could be averted; not only by space retainers, but by some form of definite denture on the lines of Dr. Willett's, so that the child's normal masticating function would continue unimpaired.

Mr. D. Hayton-Williams inquired whether Mr. Endicott did not find that the child had some difficulty in retaining the maxillary denture in view of the incline of the space. The mandibular denture would appear fairly stable, but the illustrations gave the impression that the maxillary denture might shoot forward, especially in view of the fact that the first maxillary molars were only partially erupted and gave no assistance to the dentures, being, on the contrary, a definite hindrance.

The *President* asked whether, before the child had erupted its premolars, the maxillary incisors had been inside the mandibular; whether the case was really one of an anterior protrusion from the outset, as many such cases were, or whether it was really an induced case and the mandible had been brought forward owing to the lack of any biting surface on it.

Mr. Watkin asked why the maxillary teeth had been extracted.

Mr. Endicott, in reply to Mrs. Michaelis, stated that the case was of a decidedly new type to him, and the treatment had been very much by way of experiment. He had not read the account of the cases reported by Dr. Willett in the INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, but had heard about them, and was not at all sure of the result that he would obtain in the present case. It had, nevertheless, been very interesting, and as soon as he had seen it he had immediately wanted to try what he could do to correct the jaw relationship. There was hardly enough material of this kind available to enable any one to evolve a standardized system of prevention. He had expected difficulty in retaining the maxillary denture; the child had worn the plates for a week, and he admitted that the maxillary one was retained with the aid of corega! She had apparently experienced no difficulty so far in keeping it in place. He had, in fact, been very pleasantly surprised. He had not originally intended to present the suggested treatment, because he had not thought that he would have much success with it, but the patient had been progressing with the plates much better than he had anticipated.

In reply to the president, he regretted that he could not answer the question definitely; he admitted, however, that such a condition might have existed before the extraction of the deciduous teeth. He was being guided mainly by the statement of the mother, who insisted that the protrusion had developed since the extraction of those teeth. In answer to Mr. Watkin's question, he replied that the case had been under the care of himself and his colleagues for a very short time, and that he therefore did not know why the teeth had been extracted. He supposed that there had been a great deal of sepsis around the mouth, although the mother had maintained on being questioned that the child had never complained of any toothache.

DEPARTMENT OF
CHILDREN'S DENTISTRY

A DENTIST'S RESPONSIBILITY FOR CHILDREN*

WALTER T. MCFALL, D.D.S., MACON, GA.

WHEN I was invited by your program committee to address you on the subject of Children's Dentistry, I assure you I was very happy and proud to do so. Happy because I believe, that the process of caring for children's teeth, and the many varied measures necessary to serve them correctly, honestly and adequately, will cause every one of you, to become a bigger, finer, better dentist and a more useful and helpful citizen to your State and Nation. It will cause you to feel you have more sincerely "done your bit" for the profession we honor and love, and because it will make each of you a more happy, contented man, for truly having done your real duty, that of teaching, correcting, and making more efficient our future citizens.

On the new Post Office in Washington, one reads these impressive, forceful lines, "Carry Truth and Life to All Men." As guardians of a nation's health, as professional men with a mission to our people, are we doing this, are we fulfilling the aspirations, aims, and purports of our life's work? I say, no, and the more I travel, read, see, and investigate, the more significant belches forth the very truthful realization, we have failed, fallen short, neglected, and forgot.

This question of children's dentistry is not new, it has been before the dental profession since its beginning, it has continued to grow bigger with the years, more interest is manifested, more States giving notice till even our busy national lawmakers are at last condescending to give thought and attention to the health of our children, along with their weighty deliberations of tariff, commerce, industry and things. Surely our lawmakers cannot and will not be forced to concern themselves overmuch until the rank and file of dentists themselves believe in this subject which should be of paramount interest to our membership. In an issue of the American Dental Journal is recorded a slap in the face to each and every dentist here, and frankly, one we justly deserve because it is all too true, and I wish to reecho this fact, that until we do correct the misshapen, distorted thoughts of some of the members of our profession, more harm than good will come of this concerted effort of a few to help and to educate the laity relative to the importance of mouth health and its correlation and necessity to good health, long life and happiness. Please listen while I repeat "Is the Dental Profession to Make Good?" "For years all kinds of propaganda have been employed to educate the people as to the significance and care of the mouth and teeth, until

*Read before the South Carolina State Dental Association.

today there is a wider knowledge of these important subjects than ever before. One phase of our instruction to the laity has related to the importance of mouth hygiene, to the necessity of caring for the teeth of children, and considerable emphasis has been placed on the importance of preserving the deciduous set.

"Now comes a very peculiar angle to the question, and one which must be faced with some degree of frankness. The fact is that while our writers and lecturers have been telling the people the deciduous teeth must be preserved until such time as their successors are due to appear, it is too frequently the case that when parents take their children to the dentist they are told that the deciduous teeth are so soon to be lost that there is no necessity to insert fillings or put forth any extra effort to save them. The teaching of the writers, and the practice of the operators do not tally, and there is doubt and confusion in the minds of the parents.

"If any fact is well established in dentistry it is that the deciduous teeth have an important function and a definite field of usefulness, and that they should be preserved until this function is fulfilled. Why is it then that dentists continue to tell patients such fundamentally wrong things? Is it because the management of children does not appeal to them, or that they consider it too much trouble or too unprofitable to care for the deciduous teeth? Whichever it is, there is no basis of equity or justice in it, and the practitioners who do these things are remiss in one of the most fundamental obligations incumbent on professional men. If a practitioner is unsuited by nature or temperament to properly care for children, he should be honest about it, and should turn them over to others who are in every way well qualified to perform this service, and who are glad to do it.

"There should be greater harmony between preaching and practice in this important matter, and unless we can induce our operators to change their tactics, and to make good where their child patients are concerned, we would better refrain from educating the public any further along these lines.

"The present situation is not only illogical and unjust, but it actually places the profession in a most ridiculous position before the public. We owe it to the children, in the light of what we have been teaching, and in the light of what is right and honorable, that we accept the responsibility for the proper care of their teeth, and not until this conviction finds lodgement in the minds and hearts of the rank and file of our profession can we truly be said to have made good in the estimate of the world." The oft-repeated and classic remarks of Dr. Charles Mayo years ago before the Chicago Dental Society may be paraphrased as follows: "The next great step in preventative dentistry must come from those to whom children are brought for the preservation of their deciduous teeth. The question is, will they do it?"

Time does not permit my going into detail as I should like to, and as would possibly be well as a review for all of us, but please consider with me for a little while how we can best prevent, retard and correct this appalling malady of the human race, diseased, aching teeth, sore and septic gums. Surely any thinking man of you has already concluded in his own mind and heart that a nation's greatest asset is not reckoned in it's material resources, in its achievements, nor yet by the strength and power of its army and navy, but we do know, it is respected, admired, and sought after, because of the character of its citizenship.

What does most of our money as taxpayers go to? Is it for good roads, public buildings, national defenses? No, it is for education of our children, and to the necessary upkeep of state and national institutions for those poor, unfortunate victims of disease, of mental and physical defects. Now, as never before do we have a chance to help our children, to make of them honorable, creditable, healthy citizens.

We must remember all good health begins in the oral cavity, also, that eighty-five per cent of all diseases enter our bodies through this same gateway to the body. It is our duty and responsibility to work early and late to eliminate these many state and national institutions, now necessary because of ignorance, indifference and wrong living. I say, now as never before do we as members of this great profession, have an unlimited opportunity to teach proper hygiene methods, to help with the diet and growth of children, to give to children rightful, honest, adequate dental services, to render a real service to our fellow-man, our country and our God, in the material action of conclusively bringing to pass, that great symphony of our calling, that of eliminating its necessity, by teaching and preventing the many causes for its usefulness. It greatly behooves us as economical, sound, business men to educate and help, and thereby save in dollars and cents, as well as the bigger and greater way, in human lives, for every day more children are losing their deciduous teeth, are having their much needed health, growth and mentality impaired, retarded and finally hopelessly lost, for without teeth we cannot chew properly, without chewing as we should we cannot properly digest and assimiliate our food, and without the proper utilization of our food disease and death are many times invited.

Hygiene may be described as, "The science which treats of health and its preservation." Then health is that condition of the body and mind in which all parts are functioning normally and at their best. Dental or mouth hygiene of course treats of the health of the mouth and its preservation, and in the mouth remember we find the lips, gums, teeth, tongue, muscles, fauces, nerves, mucous and epithelial tissue, blood and lymph vessels, also, the beginning of the alimentary tract and the location where the first stage of digestion takes place in the body.

For discussion and clarity, may I divided my subject into three main parts as I believe you will find it more interesting, useful and helpful in your teaching and practice with children. First, prenatal; second, preschool; and third, school age. Probably some of you will wonder at such a division but we, as one of the branches of the healing arts, must face this issue truthfully and squarely, must realize if we are to assist nature by furnishing those integral and necessary substances, the correct environment, and an inspired will to cooperate on the child's part, then we must do our all in every possible manner, if we are to hope for the best health in our children.

When one considers that no cell or body can grow, proliferate or even exist without proper nourishment, we at once turn to that now greatly studied subject of diet and nutrition. Nutrition has been ably definited as, "The assemblage of processes concerned in the maintenance and repair of the living body as a whole, or of its constituent parts." More simply it might be stated, "The nearer a food when consumed, resembles the form in which it was originally produced,

the more perfect is its utilization, by the body.'' From the beginning to the end of life, nutrition plays a most important part, and especially is this fact significant concerning the best possible condition of the oral cavity and its component parts.

Prenatal dental development actually begins about the fiftieth day of intrauterine life and closes at birth. The diet, nutrition, and metabolism of the mother must be seriously considered and directed during this period; for during the last seven months of pregnancy, the occlusal two-thirds and the occlusal one-fourth of all the deciduous teeth and the first permanent molars respectively, is formed.

The nutritional processes of pregnant women assumes even greater and more particular cognizance, when we realize the deciduous teeth should function in the surroundings of the child's mouth from about the sixth month until the twelfth year, and that the first permanent molars erupting at about the sixth year are considered the most important of all the teeth, ''The keys to occlusion.'' If later the deciduous teeth present a badly carious condition, the permanent teeth which replace and follow the deciduous teeth must necessarily erupt into a pathologic environment, or worse, alveolar abscesses will create oral foci of the most virulent nature, resulting later in systemic disturbances of a most serious consequence. If the deciduous teeth are lost too early, digestion is impaired, permanent teeth drift out of position causing malocclusion, crowding of teeth, presenting tusklike cuspids, malformed jaws, poor, unsightly esthetics, mastication is impaired throughout life, and usually periodontoclasia invariably results in adults.

We know the tooth and osseous framework of the body is composed of calcium, phosphorus, magnesium, and fluorid. Apparently it seems a comparatively simple procedure to supply these needy inorganic elements in the diet, with the expectation of their final deposition in the formation of teeth, this being theoretically possible has often been attempted, and has just as often proven a failure in actual practice. Not only do we have to consider the sufficiency of these substances in the required diet, but also the possibility of their assimilation and solubility, for the nutrition which passes into the gastrointestinal tract by no means arrives in the blood stream. A balanced diet consists in the correct quantities of sixteen essential elements, and it is our part to teach and show how important and absolutely necessary, each element really is.

Dr. McCollum tells us that, ''If calcium and phosphorus, the necessary calcifying factors are unbalanced or deficient in the female diet, the teeth and gingival tissues of the baby and mother will suffer.'' Now if the relation of comparatively simple chemical elements in the diet, such as, calcium and phosphorus, to metabolic and cell processes, in the construction of teeth is so intricate, how much more complicated must be the metabolism of carbohydrates, fats and proteins, in oral genesis and nutrition.

For prenatal diet concerning the oral cavity and especially the teeth, we advise that which is easily and safely included in the regular diet of any pregnant woman, namely: milk, nuts, entire wheat flour, leafy vegetables, citrus fruits and juices, eggs especially the yolks, spinach, beets, carrots, parsnips, peas, beans, turnips and prunes.

There is even now a belief of great magnitude among women that teeth are sure to decay, become sensitive, and to cause trouble during pregnancy and consequently the old adage, "For every child a tooth." The major portion of tooth trouble arising at pregnancy and just following childbirth may easily be minimized and made nil, provided the woman will go to a dentist the third or fourth month of pregnancy, explain her condition, and have all carious teeth either restored or at least temporarily treated, then by adhering to a strict oral prophylactic treatment of the mouth and teeth, by correctly brushing the teeth and gums two or three times a day, using some good antacid mouthwash such as milk of magnesia or limewater, and of course consume a balanced diet with sufficient calcium and phosphorus, for if these necessary elements are deficient or unbalanced, nature will surely demand from the teeth and bones of the mother, the necessary amount to replenish her requirement. It is our duty to teach and explain to mothers how and when the baby's teeth are formed, instruct them in the care of the infant's mouth, insist upon the mothers nursing their babies if they possibly can, they certainly should, and remind them, "Cow's milk was meant to make beef out of calves, not human beings out of babies." See that the baby gets a balanced diet, also orange juice, sunshine, personal hygiene, and especially a clean mouth. Advise mothers against the practice of using pacifiers or permitting thumb or finger sucking, and don't forget "Train a child in the way he should go."

The preschool age is that all important time from two to six years of age, when a child begins noticing things, and especially is this an important age for the dentist to observe and give his most needful attention. The deciduous teeth which had formed before birth begin erupting at six to eight months, and by two and one half to three years of age should all be in the dental arches, ten upper and ten lower, twenty beautiful, pearly white, little teeth which should serve until the sixth or seventh year when the first permanent molars come in behind the last deciduous jaw tooth, upper and lower, to help with the chewing and with the proper alignment for the on-coming permanent teeth. It is during the preschool age a child has most of the infectious and contagious diseases. Consequently, we dentists should be all the more concerned to have these young patients come to see us early and to visit our offices at least twice a year; for disease, long times in bed, being children having not been impressed with the importance of properly caring for their teeth, all cause the teeth to quickly decay, ache and eventually to abscess. Our most effective work should be done for children in this age period, for all too early dental troubles begin, causing the loss of the masticatory apparatus at life's most important day; food is bolted, appetite is lost, pus of the most virulent nature is absorbed and ingested, reflex pains and systemic complications occur, and here and now, seed is sown for future ill health and malformed jaws and bodies.

Very early the little fellow should be taught the use of the toothbrush, but throughout the whole period of childhood mother must see and know the teeth are properly cared for. Ideally the teeth should be brushed five times daily, upon arising, after each meal and upon retiring at night: we must insist upon night and morning brushing at a minimum. In order to have strong, healthy teeth the child's food must be chosen with that end in view. Great emphasis

must be laid upon the necessity of a well-chosen diet of mixed foods, in order that the child may be furnished with all the materials of growth. The jaws and teeth require constant exercise for proper development and growth, therefore every day the child should have some hard food suitable to his age, which cannot be swallowed comfortably without chewing such as: toast, crusts, zwieback, and later as the child grows older, boiled, broiled and roasted meats. The child should be taught to eat his food at regular times, to eat without much drinking so he will be compelled to chew his food well before he can swallow it comfortably. A very practical way to accomplish this is to keep hidden or out of sight, the milk, water, or drink until the solid food has been eaten.

Dental decay results from the acids produced by the fermentation of food particles remaining in the mouth after eating. Soft, sweet, sticky and pasty foods rich in starches and sugars easily fill the recesses between the teeth where they are not easily dislodged and of course readily ferment. For this reason when foods like the above are eaten, it is important to cleanse the teeth and mouth with especial care. The daily use of such foods as apples, pineapples, celery, toast, and other wholesome but resistant foods, aids in keeping the teeth and mouth clean.

Kindly consider for a moment animals: they eat a mixed diet of roughage, of what God intended that mankind should eat, they do not have dentists or specialists, but they do have good teeth, firm gums, and healthy, strong bodies. The Italian consumes eleven pounds of sugar per capita per annum, while the American consumes ninety-two and six tenths pounds per capita, per annum. You can compare the condition of the teeth and gums of the Italian and the American and learn for yourself the great difference.

Simmonds and McCollum have shown that the American diet which our children are encouraged to consume, is deficient in calcium and phosphorus, the necessary bone and toothforming factors; they make the assertion that we are actually feeding our children diets which induce rickets. Shipley and Park have said, "Tetany is an expression on the part of the nervous tissue, of an insufficiency of the calcium-ion; that rickets is an expression on the part of the skeleton, of distributed relations between the calcium and phosphate ion." These facts are of considerable importance when we recall that teeth and bones principally, consist of calcium and phosphorus, with other elements, which must be correctly and sufficiently combined during the childhood period if osseous and dental tissues are to be normal.

Then lastly, the school age. It is during this age that we now do most of our educational and corrective work. We need to interest ourselves more in health education in the public schools, we should assist, cooperate and help furnish correct and truthful literature, plans, programs and projects to the teachers. The average teacher has not been taught health education as she has the formal and systematic studies such as reading, writing, spelling and sciences, the teacher wants to know and is willing to use the knowledge of the doctor translated into curriculum she knows children can understand and will be impressed by.

The school age is from six to twelve or thirteen, or until the second permanent molar comes into occlusion. The child should then be turned over to the same conditions and thoughts and treatment accorded adults, for by this time,

dentally speaking, they are children no more. Every effort should be made to interest parents in bringing their children to the dentist early, regularly and systematically. Parents should be told the whole truth, they should know it is their responsibility and duty to cooperate with the dentist, to see that proper home care of the mouth is carried out, that appointments are kept, and that childhood is the time when we build health for life.

May I urge you to spend time in diagnosis, study the mouth as a whole, do not relieve the pain in one tooth when there are several teeth needing treatment. Show the parent by models, by pictures, by charts what the results of mouth infection, decaying, sore aching teeth are, institute necessary orthodontia service early, and disabuse the laity's mind that orthodontia is only for the rich, tell them and show them of the advantages in looks, comfort, in preventing sinus trouble, in preventing nasal conditions, in preventing the scourge of periodontoclasia in later life. Tell parents of the time lost in school days, of lowered resistance due to mouth infection and to the inability of a child to chew his food well. Save all the teeth, keep them useful, comfortable, and serviceable.

Every dentist has a responsibility to the children of his community and State, it is not only our duty but our privilege to have a part in giving to the boys and girls of all ages the chance they deserve, to help teach them, to see them early and interest them in themselves, to help them gain their rightful place in life of becoming and always being healthy, happy, useful citizens.

CHILDREN'S DENTISTRY*

GEORGE P. EVANS, D.D.S., JACKSON, MISS.

WHEN approached by your most gracious president in regard to what the title of this paper should be, naturally it was suggested that children's dentistry would no doubt be the logical and proper subject for me to talk about, but, with your kind permission we will call this humble effort: The ideal assistance derived from the dental hygienist in conquering preventative measures in the mouths of children with the help of the dentist. The question no doubt uppermost in your mind at present is how you may obtain and perform that ideal assistance so necessary in the carrying on of your work as a dental hygienist in connection with children.

In the preparation of this paper I have taken it for granted that the majority of those present are engaged in field work in connection with the mouth hygiene program carried on by the State Board of Health, and due to the fact that your work is confined to children, I shall treat the subject from that standpoint. Time will not permit my going into each phase of the subject in detail, but I shall try to bring out those salient factors from which you may be able to derive some benefit.

Children's dentistry may be defined as that branch of the dental profession that has for its purpose the treatment of preventive measures in the mouths of children, of preschool and school age up to the time the twelve year molar should be in place in the dental arch, usually the adolescent period.

How, doctor, you ask, can I be of assistance during the above named ages? In this connection I want to take up what I firmly believe to be the most important factor in children's dentistry, namely diet.

As messengers of future mouth conditions and due to the fact that your work carries you at times into places where the ordinary rank and file of practitioners seldom venture, it becomes your duty as disciples of health, to know and properly advise those things in diet, *not only* to children of preschool and school age, but also to expectant mothers, the foods necessary for proper bone and tooth development in the unborn child. As to the proper diet, much has been written, and it becomes necessary for us to make a diligent study of this subject, so that we as dental light housekeepers may acquire a thorough knowledge of the proper diet and its workings, applying same not only from the dental standpoint, but also as an aid to general health. I know of no other subject of such great importance, whereby, due to diligent teaching and preaching by your field hygienists, so much good can be done, for diet stands out alone as the most important basic ingredient necessary for proper tooth structure.

Following prenatal age we have preschool age or better known as the period when the deciduous teeth erupt and take their place in the oral cavity. Naturally,

*Given before the Mississippi State Dental Hygienists, Meridian, Mississippi, June, 9, 1932.

from a child specialist's viewpoint, this is the important preventive era in so far as the mouth of the child is concerned. How can you assist the dentist, you inquire, during this period? There are any number of necessary dental warnings you can pass on to the parents and children you come in contact with and which I will enumerate, first, diet, stressing importance to the mother the benefits derived from breast feeding over bottle fed methods. Next, dental hygiene methods necessary in the care of the infant's mouth and at all times preaching and teaching benefits to be derived from Dr. Sunshine and Dr. Fresh-air. Warning them against habits that have a tendency to cause malformation of the jaws and teeth, such as pacifiers, mouth-breathing, lip-sucking, finger-sucking, and bad sleeping habits. Talk dentition, informing them at just what period of the child's first two years normal eruption of the different teeth take place. Advise periodical visits to the dentist and careful home treatment of the mouth, emphasizing at all times the necessity and importance of cleanliness.

We are all aware of the fact that during this particular age, dentistry is and has been woefully neglectful of the child. The realization that baby has a mouth and that just in proportion that this mouth is cared for and given the proper attention it deserves, from time the first tooth erupts until at least adolescence, under parental and dental watchfulness, will assure that child of the chance in life it should have. No child should be considered too young to be taught to begin the care of his mouth and teeth under parents guidance by the time his baby teeth have all arupted.

It ill behooves me to censor anyone, and, not forgetting the great importance of the six year molar, to state right here, that I believe we in the past have brought so much pressure to bear on the importance of the six year molar and laid so much stress on the word *permanent teeth,* and in so doing we have just about convinced the laity that about the only benefit to be derived from the primary dentition is esthetic and the joy of finding baby with a new tooth.

I realize fully how necessary it is to keep before the parents the importance of the key tooth in the mouth, but I do not think it advisable to forget the deciduous teeth, for the time may come when the big permanent *six year giant* may have need of the little fellow just ahead to lean upon.

I think we are all convinced that proper relationship should exist between the deciduous tooth and the first permanent molar and it is just as important to protect one as the other from an occlusion standpoint.

The time is fast approaching when this particular condition will cease to exist and when the truth does finally come out, we are going to discover that preventive dentistry with the child will be the means of doing away with dangerous systemic conditions occurring later in life which could have been corrected early in childhood.

"Knowledge without health cannot profit us"—a real interest at present is being manifested and preventive truths give real results under their effective administration. There is a paramount need for correct and truthful preventive literature and technic. We have depended entirely too long on paid writers for highly advertised dental products to tell our story and now is the time to correct and change some of these false doctrines and set people right with the truths. Preventive dentistry should be for all children, not just the underprivileged and

charity, all children should be taught and helped. Dentistry is a necessary health service and not an expense and luxury. We should all understand that it is the lesson taught and learned that is appreciated in the preventive line, due to its large scope it is educational, and we are called upon to preach and teach more than we are to operate. It is your duty to interest the parents in the child's whole mouth and not just point out the offending tooth or teeth that has perhaps caused the parents much disturbed slumber.

We come now to the period in the child's mouth known as the school age, the one I take it, with which most of you are familiar, and it will be somewhat easier to talk about.

Many conditions present themselves at this time for normally we usually have the deciduous as well as the permanent tooth to deal with. It is also evident in most instances that the majority of dental disturbances are most noticeable and in greater quantity than at any other time.

Here we find the diseased abscessed tooth with fistula, faulty tooth formation, malocclusion, missing deciduous teeth, dirty mouths, and any number of dental discrepancies. How are we going to deal with the above stated defects?

First, as perhaps you all readily realize, since it pertains to your line of endeavor, and I believe one of the most important phases of dental practice, namely, prophylaxis is always necessary. There is nothing as important as a good thorough prophylaxis if along with the operation the hygienist takes the necessary steps to inform the child the necessity of keeping the oral cavity clean. If this educational part of our prophylaxis is neglected we really have not accomplished a great deal. Knowing the type of work you young ladies are capable of doing I shall not dwell on this phase of children's dentistry.

The next prophylactic phase I want to take up is the use and misuse of ammoniacal silver nitrate. This subject I will postpone until the table discussion along with the problem of space retainers, where I hope to be able to show you the indications and contraindications for their use.

You are daily confronted in your examinations with the abscessed tooth with fistula and if your experience has been similar to mine, oftentimes it provokes a perplexing problem as to what disposition to make of said case. Frankly, what experience I have had in this connection in treating such cases has not been of a satisfactory nature and although my treatment may at first seem somewhat drastic, the systemic disturbances naturally following the retention of a chronic abscess in the mouth of a child, prompts me to follow the only safe way out *known as extraction.*

There seems to be some doubt in the minds of practitioners as to the advisability of this procedure, but if the theory of foci of infection is correct, accompanied with all its disturbances, then the matter of retaining of space becomes too simplified and results of retaining the abscessed tooth so dangerous that I prefer to let the sunshine on the roots of said tooth and if absolutely necessary sacrifice *beauty for health's sake.*

If you as hygienists want to assist in the development of the child's health, see to it, by all means that all abscessed teeth are extracted and discount the idea that a tooth in such a condition can serve as a means for proper space maintenance.

The final question propounded in your connection as a mouth hygienist with the dentist will no doubt be "what have I accomplished?" We are not able to guarantee or say, but we can surmise and it will not be an idealistic supposition into the land of make believe or may be so, but when preventive measures are both taught and practiced by the dental profession at large, the public will be enlightened with positive facts and will rise up and call us blessed.

It is not impossible for children to be brought into the world with the dental characteristics that go to make up a healthy, useful set of baby teeth. It is your duty to interest those parents and children in the proper time for visits to the dentist and the proper home care of the mouth and teeth, to give to the people everywhere that high type of professional care and advice through the medium of educational work that will prevent the scourge of defective teeth and gums with their allied sequelae of degenerative, infectious, and contagious diseases. In so doing children for whom most of our taxes go for education will be physically, mentally, and morally free to avail themselves of our present-day advantages and in time become the men and women, fathers and mothers each one has hoped he might become.

The dental hygienists and dentist will then enjoy their work, and be proud of their opportunities and possibilities for making this a better place in which to live, knowing they have done their all in trying to make out of the future citizenship of this country, a more healthy, happy and useful body of people and having earned the love and respect that is always forthcoming to those of us who have served conscientiously and well with our present-day opportunities.

HEALTH EDUCATION IN THE PUBLIC SCHOOLS*

WALTER T. MCFALL, D.D.S., MACON, GA.

ON THE Post Office in Washington one reads these impressive, forceful lines, "Carry Truth and Life to All Men." I feel it is just such a motive and spirit which dominates all, guides all whom are trying to help others be healthy, happy, and useful in this life.

The late world's war taught us many things, but nothing more assuredly than, a nation's greatest asset is not reckoned in the strength of its army and navy, nor in its possessions, achievements, or resources, but it is respected, admired, and looked to—because of the character of its citizenship. As a sound, economical business man, one must see that most of our money as taxpayers goes to the necessary upkeep of our public schools for the education of our boys and girls and for the maintenance of state and national institutions for those poor, unfortunate victims of disease, of mental and physical defects.

You teachers well know you, are in the biggest business in this nation, into your hands are given more than twenty million children to build into a race, a race, of which we shall be proud, of which democracy, world peace and the things which last and live and bless will be kept safe and enduring. There is no business in America in which so many people are engaged as in your profession and contribution to life. Those things for which our people pay more than two and a quarter billion of dollars each year, for our educational institutions cost this stupendous figure, are not quickly or easily demonstrable, for the process of education builds often exceedingly slow. I believe many of you are serving for the joy of the work, for the love of youth, for those things which are unseen for the materialist and I pray you may never lose sight of your responsibility, of your duty, of your possibilities and of the satisfaction, contentment and peace which always comes to one from having served and served well.

At one of the meetings of the National Educational Association you and your representatives and leaders went on record, declaring that among your seven significant objectives and essentially basic fundamentals, that the teaching and practical inculcation and utilization of health was first and foremost, or better, that, "Knowledge without health cannot profit us." There is today no more important development in our modern program of public education than that which relates to the health and its maintenance of our children in schools and through life. There have been attempts made for the last twenty-five years to take care of the health of school children and to teach them in matters relating to health, but for the most part until the last decade it has been slow, inefficient rather desultory and not very successful.

I feel sure we will all agree it to be the function of education, to prepare the rising generation for the duties and responsibilities of life, to teach them to live

*This paper was given before the Georgia Educational Association in Americus, Georgia.

with each other, to create within them an earnest desire for the highest, finest, and most worth-while things of life, to be useful, to be industrious, and to respect and consider their bodies as the temples of God. Next to the moral and ethical questions of life nothing is quite so important as health. We have all come to understand we are not teaching subject matter, not the three R's, not how to make a dollar but we are teaching, the child, the whole child in all his relations to life how to make a living and to deserve and merit his self-respect. Our boys and girls of today will succeed in life as father and mother, man and woman tomorrow, largely as we have taught and impressed them now, what are you helping to build, stumbling-blocks or stepping-stones? I have said health teaching at times in the past has been desultory, ineffective, yea and in many cases even repulsive to both teacher and pupil. Because of the failure to teach and appreciate health in our normal schools and in our own lives, the educator has not been encouraged and taught to interpret the knowledge of the doctor.

We all feel that more is to be accomplished through the public schools and through the well trained, adequately prepared and earnest conscientious classroom teacher than through nearly all other institutions and organizations. The work of the home, community and almost the church at times has been relegated to the schools and the teachers held responsible. Schools are doing the biggest, most worth-while and most effective work now they have ever done and progress is noted on every hand as an end-result of this magnificient service.

The Protestant Reformation bequeathed us the idea that education is purely a matter of literacy, being able to read and write language. Later came the Political-Educational idea from Thomas Jefferson and his confreres, that this is a democratic government and must depend for its success upon the intelligence of the electorate, the masses; therefore the masses must be educated to read, if not to write, the political literature, consequently, only literacy again. But now a change is in progress for we have learned if we are to really educate a people who will be safe for democracy or with whom even religion will be safe, we must of necessity educate the whole individual. This health motif together with a few others in education must transform and is transforming the whole of education, for now we begin to understand that health education strives to emphasize all phases of health: mental, physical, social, and moral. It behooves each and all of our profession to think of our teaching and work in an organic way. May we all understand that health education is a procedure to supplement and assist, not to supplant or replace other school health activities.

Personal hygiene has changed the habits of daily life. The modern public health movement is definitely a movement for bettering the health conditions of the community, which of course depend upon the health of the individual. The Public Health Nurse has found that people do not understand the simple and important things she tries to teach them because they have had no training in these elementary fundamentals of a fuller, happier life. Gradually and slowly we have been forced to see and realize that if we are going to attain the ideals of health we must go back into the schools and teach them something about hygiene.

The reception given health training and instruction from both the school authorities and children has been far beyond our highest dreams or fondest hopes. You teachers realize the methods employed in the past, we have seemed

to stress entirely habit formation until the work has been unattractive, and we have almost made of the child an automaton. Habit formation should be our first aim, but we must also lay a sound basis of knowledge which will help the child to modify his habits to meet changing conditions of life. "The goals of health instruction are to establish: (1) health habits, (2) to give the child the practical knowledge of the principles of healthful living, (3) to develop health ideals, (4) to arouse a sense of individual responsibility for the health of the community, and (5) community responsibility for the health of the individual."

Now comes the question: How can we reach these goals? It seems clear now that the inculcation of a necessary knowledge of the fundamental principles of healthy living requires a certain amount of formal, systematic instruction in a classroom. I know that many of you will rise up to say that some of the most effective teaching of hygiene is being accomplished in certain schools where no textbooks are used, or no formal period set aside for this study. Hygiene permeates the whole school curriculum, it is most effectively taught by indirect-direct correlation with many school subjects, but honestly I believe, the average teacher in the average school will never become a health enthusiast, or potentially, a well rounded teacher as she might, until there are hours or periods set apart for health teaching; until she is graded and promoted by her work in hygiene as in other subjects; and until she is trained in hygiene and health instruction in a normal school or college as she is trained in arithmetic or English grammar, or reading, today. Not for anything would I sacrifice what has been taught in a heroic, earnest manner as extracurricula activities by the splendid enthusiastic methods of appealing to the imaginations and wills of children, but I feel that we accomplish our maximum effect only when this work is correlated with definite and formal instruction. The exact stage of school life at which formal, systematic instruction should begin is entirely debatable, from my experience in health teaching in rural, urban, city, textile, and private schools with more than a thousand teachers, I am led to believe that in the kindergarten and first three grades the main effort should be to develop health habits by rote methods, inspections, drills and special devices; but that the fourth grade is not too early a point for the commencement of formal instruction.

We shall not go into that vast field of what shall be taught from the fourth grade through the high school but suffice it to say if we are to strive for the goals previously outlined, we must not only teach basic biologic and physiologic principles, but also some such essentials as (1) To differentiate between dirt which is dangerous and dirt which is merely unsightly. (2) Between harmful and harmless bacteria, especially stressing the former types, nearly all of which have their origin only in the human or animal body. (3) In regard to communicable and infectious diseases, how contracted, how spread, and the importance of water, light, and food supply as factors in disease. (4) The importance of caring for the sick, how to do simple first aid, how to protect the other members of the family or community, then the importance of the fly nuisance and of the principles of vaccine and serum therapy. (5) The control of tuberculosis, of degenerative diseases, of infant mortality and lastly the workings of necessity for a City, County and State Board of Health should certainly be taught higher grade children.

Finally let us remember the teaching of a few things is not enough, that no one phase of health work is more important than another, that it is impossible to treat just an eye, a tooth, an arm without treating or recalling the relation of the part to the whole body. All phases of health work are important and are helpful only in proportion as they are correlated and interrelated one to the other. Our effort is to help and to save the whole individual and to make and keep him healthy, happy, and useful.

"There is nothing in all the world so important as children, nothing so interesting. If you ever wish to go in for philanthropy, if you wish to be of real use in this world, do something for children. If ever you yearn to be wise, study children. If the great army of philanthropists ever exterminate sin, pestilence, and disease, it will be because they began very early in life with children." Our Greatest Teacher taught us that it is a fine thing to be as little children, simple, hopeful and ever desirous of the best and happiest things in life. Will you not give to those children in your charge the instruction, the inspection, the training they should have that will enable them to have the chance they deserve in life of being healthy, happy, and useful in body, mind, and soul?

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

GRANULOMA INGUINALE, WITH REPORT OF A CASE WITH ORAL INVOLVEMENT*

RALPH S. MUCKENFUSS, M.D., AND J. B. BROWN, M.D., F.A.C.S., ST. LOUIS, MO.

ALTHOUGH the disease known as granuloma inguinale, granuloma venereum, granuloma tropicum or ulcerating granuloma of the pudenda has been known since the latter part of the past century,[1, 2] it was not until 1913[3] that any cases were recognized in this country, and it is only since 1920 that its frequency has been recognized.

Although not common, its frequency is such that a brief description of the usual clinical appearance and course is justified. The disease is much more common in negroes than in white people, the ratio apparently being in the neighborhood of nine to one. The first lesion noticed is usually a small papule in the groin. This gradually increases in size, ulcerates and continues to spread superficially, leaving a red, exuding, granulating area that shows little tendency toward healing. Where folds of the skin approximate, the disease can spread by contact as well as by extension from the edges, and the extension tends to be somewhat greater downward. Enlargement of the regional lymph nodes, while frequently observed, appears to be the result of secondary infection of the granulating surface and not the result of the disease itself. The lesions, unless checked by treatment, will spread until death finally results. Although the disease usually is limited to the region of the groin, it can occur on other parts of the body, and lesions have been produced on the back by inoculation. Ectopic lesions are particularly likely to cause difficulty in diagnosis.

Etiology.—The structures described by Donovan in 1905,[4] and commonly known as "Donovan bodies" are usually thought to be living parasites of some nature and to be the etiologic agent of the disease. Donovan considered them to be protozoa, while Siebert[5] who described the same structures in 1907 without knowledge of Donovan's observations, thought them to be capsulated bacteria. The disease was at first thought by some to be a form of syphilis,[6] and some authors observed spirochetes,[6, 7] but these findings have been so infrequent as to make them seem incidental and not of significance in the etiology of the disease. Since the Donovan body is the only constant finding, and the one which has been most studied, the question of etiology will be discussed with particular reference to this structure.

*Department of Internal Medicine and the Surgical Service of Dr. V. P. Blair, Washington University School of Medicine.

The Donovan bodies (Fig. 1) are small oval bodies occurring in the cytoplasm of the large mononuclear cells as a rule, occasionally in the polynuclear cells, and apparently sometimes in epithelial cells. In the center of each of these bodies is a darker staining mass, so that the appearance is that of a capsulated bacillus. This interpretation of the appearance seems to be justified in the light of much of the work that has been done. A majority of the men who have cultured the lesions have observed growth of a capsulated bacillus[8-15]—a member of the mucosus capsulatus group—which morphologically is identical with the Donovan body. At this point, however, little further progress has taken place. Inoculation of these cultures into animals and into human volunteers has occasionally resulted in abscess formation but nothing resembling the spreading ulceration of the disease. Goldzieher and Peck[14] observed the development of a granulomatous lesion in an inoculated rabbit, but most workers doubt that they reproduced the

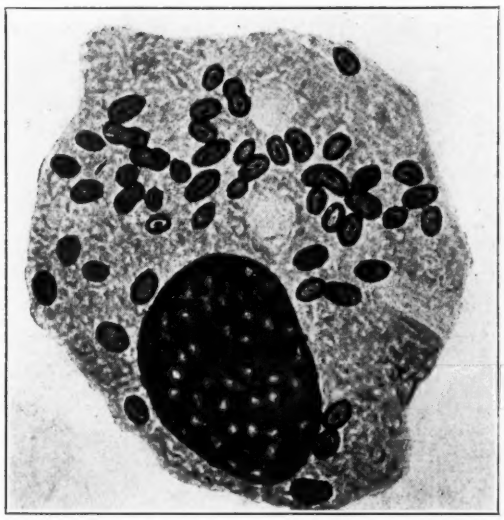


Fig. 1.—Typical organisms or Donovan bodies. Reproduced from *Handbuch der Urologie,* V. Lichtenberg, F. Voelcker, H. Wildbolz.

disease under consideration. McIntosh succeeded in reproducing the[16] disease in a human volunteer by the inoculation of ground tissues from an active lesion; filtrates inoculated at the same time did not cause the disease to appear. This would seem to exclude an infectious agent filterable regularly through a Berkefeld candle from consideration in the etiology of this disease. The consistent failure of so many individuals to reproduce this disease with the various cultures of capsulated bacilli caused Castellani and Mendelson[17] to state that either the Donovan body is not the cause of the disease or the cultures are not cultures of the Donovan body. This is essentially the situation today with regard to the nature of this structure. It should be mentioned, however, that DeMonbreun and Goodpasture[18] failed consistently to grow members of the mucosus capsulatus group. In inoculating uncontaminated material from a fresh lesion into the prepuce of a monkey they observed the development of a chronic lesion which after a time gradually retrogressed, and in which numerous Donovan bodies could be seen. Although recognizing that they had not reproduced the clinical

disease, they felt that they had found a biologic test by means of which any organism suspected of having an etiologic rôle could be tested.

Diagnosis.—The presence of a chronic, spreading, ulcerative lesion of the inguinal region, with a characteristic appearance is almost diagnostic. Epithelioma, blastomycosis and tuberculosis of the skin are the conditions most likely to be confused with it. Third stage lesions of syphilis may be confused with it or occur along with it. The syphilitic lesion is probably more localized and more deeply destructive with a "punched out" moist appearance. A smear of scrapings from the surface, stained with Wright or Giemsa stain will frequently reveal the presence of Donovan bodies. When found, these are considered diagnostic of granuloma inguinale. Such an examination may be of extreme value when lesions are not typical or are located in other parts of the body.

Treatment.—Fortunately, a specific treatment is available, and the prompt healing under adequate therapy is almost diagnostic of granuloma inguinale. Aragao and Vianna[19] were first, in 1913, to use tartar emetic intravenously in the treatment of this disease, and their good results have been universally confirmed. The drug is usually used in 1 per cent solution, given in doses of 2 to 10 c.c. every other day. It is essential that the treatment be continued for some weeks after the clinical cure of the local lesions, otherwise recurrence is extremely likely to occur.

The failure of this drug in some instances has lead to the use of salvarsan intravenously, and of x-ray therapy locally. In the case reported here all these measures failed, and radical cautery excision of the inguinal involvement was done. Healing was accomplished later by skin grafting the raw areas.

This radical surgical treatment was thought to be successful but after two years the patient returned with a wide area of involvement of the lips and a small area in the inguinal region (Fig. 2).

CASE REPORT

A negro, forty-eight years old, entered the skin clinic with widespread ulceration about the inguinal regions and over the penis. The ulceration was of eight years' duration. The Wassermann report was negative and a diagnosis of granuloma inguinale was made.

Treatment by intravenous injections of 1 per cent tartar emetic (antimony and potassium tartrate) was given for about one year. The disease did not respond to treatment and some salvarsan was given. After several hundred injections of tartar emetic Dr. Sherwood Moore treated him with x-ray therapy and it was thought that there was an arrest of the disease. He was then referred to this surgical service and examination showed large areas of deep ulceration over the inguinal regions and over the dorsum of the penis.

Surgical treatment consisted of widespread and deep destruction of the lesions with the actual cautery, and later repairing the areas with thick split skin grafts taken from the thighs. (Operations done by Dr. G. K. Lewis, then on service.) Three months later two small ulcers were excised from the penis, and it was thought that the disease was cured.

Microscopic diagnosis of tissue from three different areas showed only chronic inflammation, although some malignant change might have easily been expected around the edges of the ulcers.

Heavy doses of tartar emetic were kept up, but in getting in the patient's veins trouble developed and he stopped treatment.

Oral Lesion.—About two years later the patient reported again for treatment in a miserable condition. In the last few months he had had an extremely sore mouth and teeth, and a widespread ulceration had developed on his lower lip (Fig. 2). This lesion involved the entire lower lip, and it hung almost useless with a discharge pouring from it and from around very badly infected gums. The center of the lip over the entire vermilion was a shallow ulceration with heavy crusts over it. Each angle of the mouth, including part of the upper as well as the lower lip, presented a deeper ulceration with hard rolled edges, either area of which might be mistaken for carcinoma.

Diagnosis of the Oral Lesion.—In this instance with the former history to go on, the first suspicion was that the lesion was secondary to the granuloma inguinale. Direct smears from the lesion revealed the Donovan bodies, and it was

Fig. 2.—Shows widespread involvement of lower lip with deep lesions at each angle extending on to the upper lip.

thought that the diagnosis was complete. Third stage lues had to be ruled out, and it was found that the patient's Wassermann report had been negative throughout the observation. Carcinoma, rightfully, should be considered but the local points against it were: (1) frank evidence of an inflammatory process; (2) too widespread involvement; (3) the lesions that were most identical with carcinoma were situated at each angle of the mouth not directly connected with one another, and it was thought that the occurrence of two carcinomas would be extremely rare.

Treatment of the oral lesion was outlined to include: (1) active tartar emetic dosage; (2) general improvement in oral hygiene; (3) possibility of cautery destruction of the entire area as had been done in the inguinal region if there was failure of healing under tartar emetic.

COMMENT

(1) This patient affords an excellent example of the wide range of possibilities in the diagnosis of oral lesions.[20, 21, 22] The diagnosis would almost assuredly have been missed if the history had not been known, if a general physical

examination had not been done or if the Donovan bodies themselves had not been found in the direct smears. (2) The most common mistake in diagnosis of this patient would be to confuse the lesion with carcinoma. To diagnose a suspicious area as malignant is the safe side to be on, and if necessary a biopsy should be done. It is true that we must constantly be reminded of the fact that two lesions can exist at the same time, and especially is this true of oral syphilis and oral carcinoma. (3) The mode of transmission and of inoculation is not definitely known. Some observers do not even think that the disease is primarily a venereal disease. However, there is urgent need for immediate and complete control of the disease in the present form in this patient, for widespread contamination can take place from him.

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ULCER OF ORAL CAVITY AND TONGUE

(LESIONS OF THE ORAL CAVITY AND OF THE JAWS AND OF THE REGION OF THE JAWS, INCLUDING THE TEMPORAL FOSSA, ORBITAL CAVITY AND SINUSES*)

JOSEPH COLT BLOODGOOD, M.D., BALTIMORE, MD.

(Continued from page 882)

CLINICALLY, in the gross and under the microscope a nonmalignant ulcer is, for practical purposes, identical, no matter what its size or location. The defect due to the disappearance of the epidermis of the skin or mucous membrane is replaced by granulation tissue resting upon a fibrous base. At the edge of the ulcer there is, as a rule, some evidence of epithelium attempting to grow over the surface and downgrowth of the epithelium extending into the granulation tissue. The superficial cellular granulation tissue varies in vascularity and amount of fibrous tissue, and the fibrous base shows variation in degree of vascularity and density of the intercellular elements. In tuberculosis one usually sees the tubercle with its specific giant cells. In the syphilitic ulcer lymphoid cells predominate, and, as a rule, there is less fibrous tissue. With these two exceptions, there is nothing particularly characteristic, under the microscope, of acute or chronic ulcers which may be caused by various infections other than by the tubercle bacilli or the spirochetes of syphilis. A malignant ulcer differs from a benign ulcer only in the fact that cancer cells predominate in the granulation tissue. In most instances the cancer cells predominate in the granulation tissue zone, but in both the benign and the malignant ulcers, the malignant cells or inflammatory cells may be observed outside the ulcer zone. When the ulcer is larger than a ten-cent piece or a silver quarter of a dollar, the different types of ulcer have different appearances. The syphilitic ulcer has a punched-out gross appearance. The epidermal edge is not elevated; induration is slight. In the mucous patch there is no induration. The tuberculous ulcer has ragged edges, and the epidermal edge is undermined. The surface is often necrotic, and there is not much induration. The benign ulcer of an unhealed wound not associated with any specific infection looks more like a syphilitic ulcer than a tuberculous ulcer and, as a rule, has more induration than either. Excessive induration is characteristic of the ulcer in actinomycosis. Minute sinus formation is often present in the tuberculous and actinomycotic ulcers. In the cancer ulcer there is, as a rule, a definite elevated rim composed of the edge of epidermis beneath which one can feel the indurated zone of infiltrating tumor cells. Cancer cells always infiltrate beneath the epidermal edge to a greater extent than the inflammatory cells of the granulation tissue, and this gives rise to the characteristic elevated edge and induration.

*One of a series of articles by Dr. Bloodgood that will appear in the JOURNAL over a period of eighteen months to two years. Originally published in *Lewis' Practice of Surgery*, W. F. Prior Company, Inc., and brought up to date.

As a rule, in the mouth, no matter where the ulcer is, it is a dangerous thing to make a diagnosis on gross appearance only. I think it is always possible to recognize the little canker sore; it is minute, it has a peculiar white surface, it is quite tender, and it heals quickly. It corresponds to the fever blister on the lip.

When the ulcer, no matter what its size, is of a few weeks' duration, one should search for and remove all the possible causes. A few ulcers are due to infection with the organism of Vincent's angina. They are never larger than a ten-cent piece and never indurated. They look somewhat like a mucous patch.

Fig. 22.

Fig. 23.

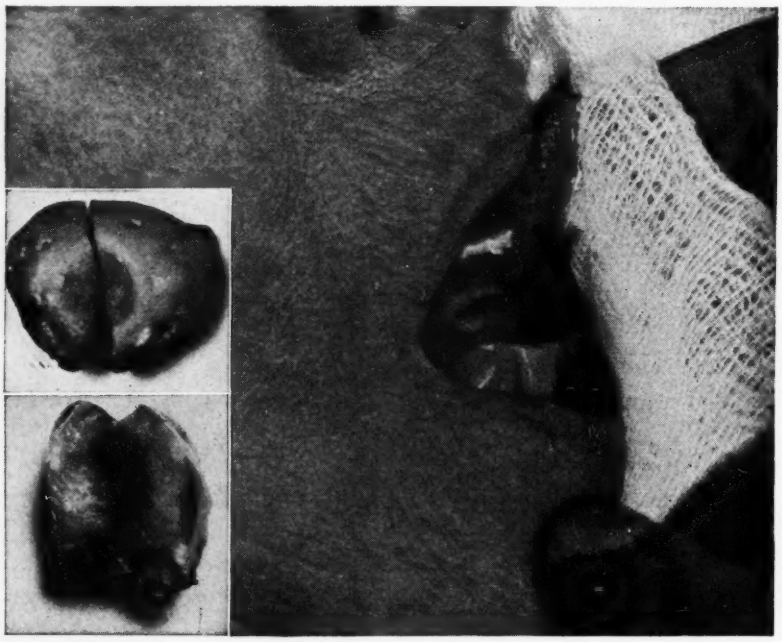

Fig. 21.

Fig. 21.—Pathol. No. 17528. Benign ulcer of the tongue due to the wound from a ragged tooth. Complete excision in 1915. Well in 1928.

Fig. 22.—Pathol. No. 17528. Photograph of the area excised with the ulcer shown in Fig. 21. Notice the sharp epidermal edge and the smooth surface of the ulcer. The needle wounds of the hypodermic show in the mucous membrane around the ulcer.

Fig. 23.—Pathol. No. 17528. Bisection of the ulcer shown in Fig. 22. In the position of the ulcer there is no zone of opaque white tissue characteristic of cancer, but the ulcer zone, gray in appearance, is given a good margin of healthy mucous membrane and muscle.

The spirilla of Vincent's angina are seen in smears. Treatment with perborate of soda, cleansing the teeth, and the removal of tobacco, if present, show results within ten days. I have discussed this in detail under Vincent's angina. Often the ulcer is the result of a recent wound—biting the tongue or cheek—or the wound from a foreign body, or the wound inflicted by a dentist during his work, or by a surgeon when operating on the tonsils. With cleanliness, these wounds heal quickly. In other instances one can see the offending ragged tooth which must be smoothed, properly filled or extracted. Of it may be the ill-fitting plate which must be removed until the ulcer has healed. Ulcers are now and then complications of extensive pyorrhea and appear on the gums. The ulcer may occur anywhere from any of these causes. Some disappear when the causes are removed, others persist, and with the exception of the tuberculous ulcer, all have

a tendency to develop into carcinoma. I shall discuss later the tuberculous and syphilitic ulcers, also that due to Vincent's angina. I shall illustrate here the ulcers in leucoplakia, the results of injuries from teeth or plates.

Benign Ulcer Due to the Irritation From a Ragged Tooth.—Figs. 21 to 25 perfectly illustrate such a chronic ulcer. This ulcer was situated in the posterior third of the tongue, directly opposite a ragged molar tooth. The patient, aged seventy years, was aware of the irritation from the tooth and the soreness of her tongue for two months before the tooth was extracted. One month later the ulcer had not healed. For this reason it was excised with a good margin of

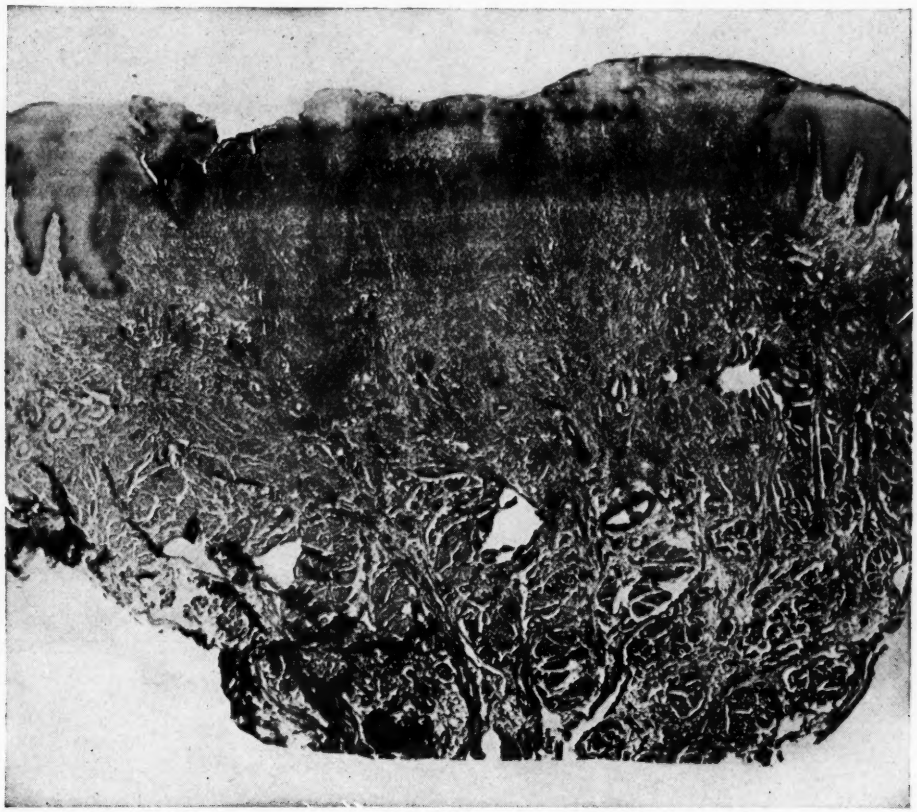

Fig. 24.—Pathol. No. 17528. Photograph of the entire section taken through the ulcer shown in Fig. 22. Compare it with the bisected picture in Fig. 23. Note the normal epidermis of the tongue to each side; the infiltrated tissue replacing the epidermis and extending into the muscle beneath. The margin of healthy tissue in Figs. 22, 23, and 24 would be sufficient for cancer.

healthy tissue, as shown in Fig. 22. There has been no recurrence since 1915, thirteen years before.

This establishes a good rule. If after the removal of a definite cause an ulcer does not heal quickly, it should be completely excised as a possible malignant ulcer, no matter what its appearance may be. In this case there was no history of tobacco, the Wassermann test was negative, there was no factor but the tooth. We have examples of malignant ulcers from this single etiologic factor.

In the ulcer shown in Figs. 21 to 25 there was no atypical growth of epithelium at the ulcer edge.

A Typical Growth of Epithelium in Ulcer.—Fig. 26 is the photograph of a minute ulcer on the side of the tongue opposite a ragged tooth. It had been present but ten days and had not healed for six days after the extraction of the tooth. Its edges were undermined as in a tuberculous ulcer. It had the induration of cancer. The Wassermann test was negative. Except for the pressure of this tooth, the other teeth were clean and normal. For safety it was completely excised with the cautery in 1922. The patient was well in 1929. Figs. 26, 27 and 28 show the ulcer and the atypical downgrowth of the epithelium. I believe it

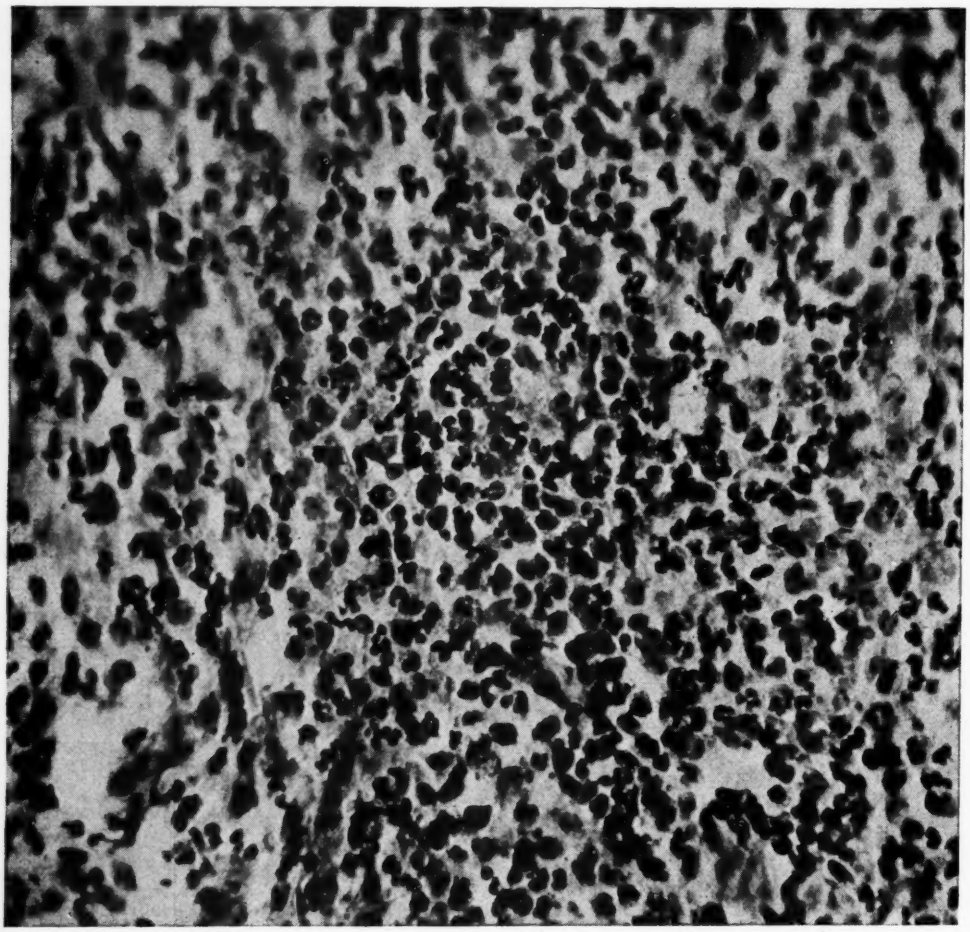

Fig. 25.—Pathol. No. 17528. Photomicrograph, high power, of the ulcer shown in Fig. 24. This shows the cellular granulation tissue. Compare this with the photomicrograph of the fibroma in Fig. 15, tuberculosis (Fig. 36) and cancer (Fig. 58).

is impossible to conclude whether this ulcer is yet cancer or, if not cancer, whether cancer would have developed later. There seems no question that complete excision was an operation of necessity.

One should always be suspicious of malignancy in the presence of an unhealed ulcer anywhere, and especially in the oral cavity. If the ulcer is of recent origin (less than one month), one is justified in searching for and removing causes, and then if the ulcer does not heal, it should be completely excised with a margin sufficient for cancer. When the size of the ulcer would

make complete excision mutilating, biopsy should be done with the cautery. In my experience biopsy is rarely necessary except in tuberculous ulcers which are generally recognized clinically and because of evidence of tuberculosis of the lungs. When the ulcer has been present more than one month, the etiologic factors should, of course, be removed if present, but it is dangerous to wait long for healing, especially if there is any induration. I shall discuss this again under tuberculosis, syphilis, and Vincent's angina.

We have not a record of a benign ulcer previous to 1907. In the thirteen years up to 1920 there are about seven benign ulcers. Since 1920 there are almost twice as many. Many cancers of the oral cavity give a history of ulcer. Leucoplakia is more liable to change into warts before the development of cancer than to ulcerate. The chief causes of ulcer that later develop into cancer are

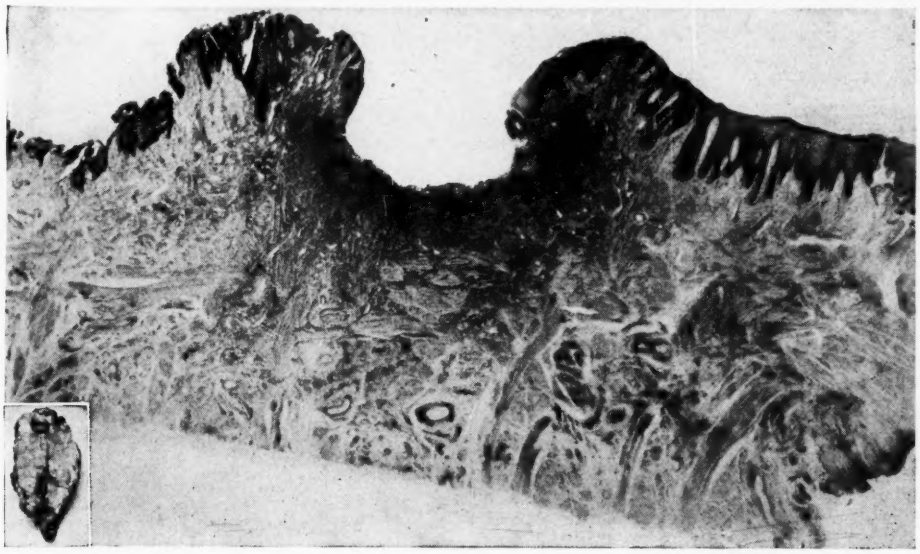

Fig. 26. Fig. 27.

Fig. 26.—Pathol. No. 32217. Minute ulcer of ten days' duration, opposite a ragged tooth. Excised in 1922. No recurrence in 1928. The illustration shows the actual size of the tissue removed. The ulcer had the undermined edge of tuberculosis and the induration of cancer. See Figs. 27, 28, and 29, for microscopic appearances.

Fig. 27.—Pathol. No. 32217. Photograph of the section through the tissue shown in Fig. 26. The ulcer and its margin are pictured.

the injuries from ragged, dirty teeth and ill-fitting plates in conjunction with the excessive use of tobacco.

There is no mutilation in the complete excision of an ulcer of the size shown in Fig. 22 or even a little larger, no matter what its situation in the oral cavity may be. Up to the present time we had to split the cheek only once for the excision of a benign ulcer, one situated far back on the base of the tongue.

APPENDIX

Although there will be further publications on the different types of ulcers—syphilitic, tuberculous, cancer, Vincent's angina, actinomycosis—a little repetition right here will be helpful; and I have become more impressed with the technic of diagnosis and treatment in the past four years, because the number of

very early ulcers which are not cancer, syphilitic or tuberculous, are on the increase. These are ulcers due to Vincent's angina infection, pyogenic infection, pressure from plates, irritation by teeth, or some recent injury from a foreign body. It is to be remembered that more and more people are getting the correct information that the best thing to do when they become conscious of a sore spot in the mouth is to go to a dentist or a physician, so that we are seeing more and

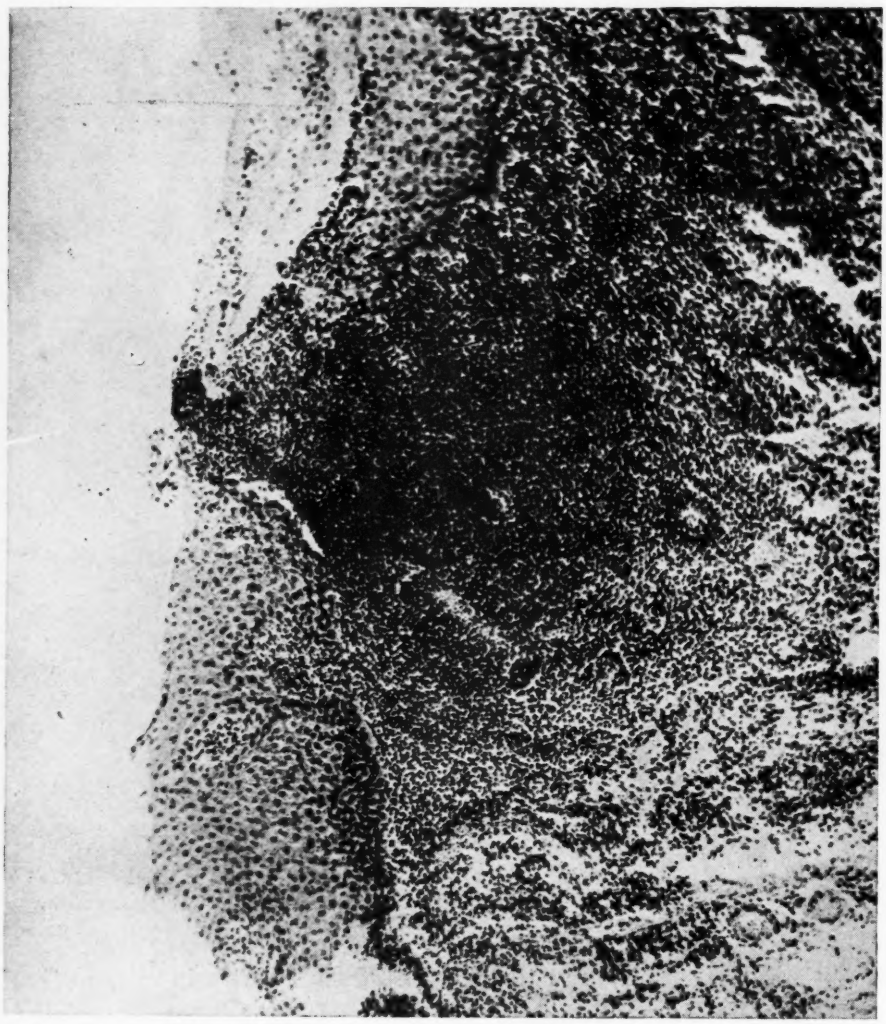

Fig. 28.—Pathol. No. 32217. Low-power photomicrograph of ulcer shown in Fig. 27. Note the surface epithelium resembling that of leucoplakia. (The patient was an excessive smoker of cigars and had some patches of leucoplakia.)

more local lesions which would disappear spontaneously if the patient delayed. We are also seeing more and more lesions which, if the patient delayed, would come under our observation in the stage of cancer.

Multiplicity of small ulcers is against malignancy and favors Vincent's angina, syphilis, tuberculosis, or some type of infection or injury. The easiest to recognize are single or multiple so-called canker sores which seem to have an etiologic relation to some type of stomach upset due to faulty food, or some low-

grade infection. From my experience, the worst thing to do for these single or multiple ulcers is to treat them with any caustic, even silver nitrate. If Vincent's angina is present in the cover slips, then, of course, the treatment with sodium perborate is tried. The next thing to do is to clean the teeth, and only a dentist can do it properly. Temporary treatment of the little area with mercurochrome, S.T.35, chlorazene, is not harmful. Perhaps rinsing the mouth with bicarbonate

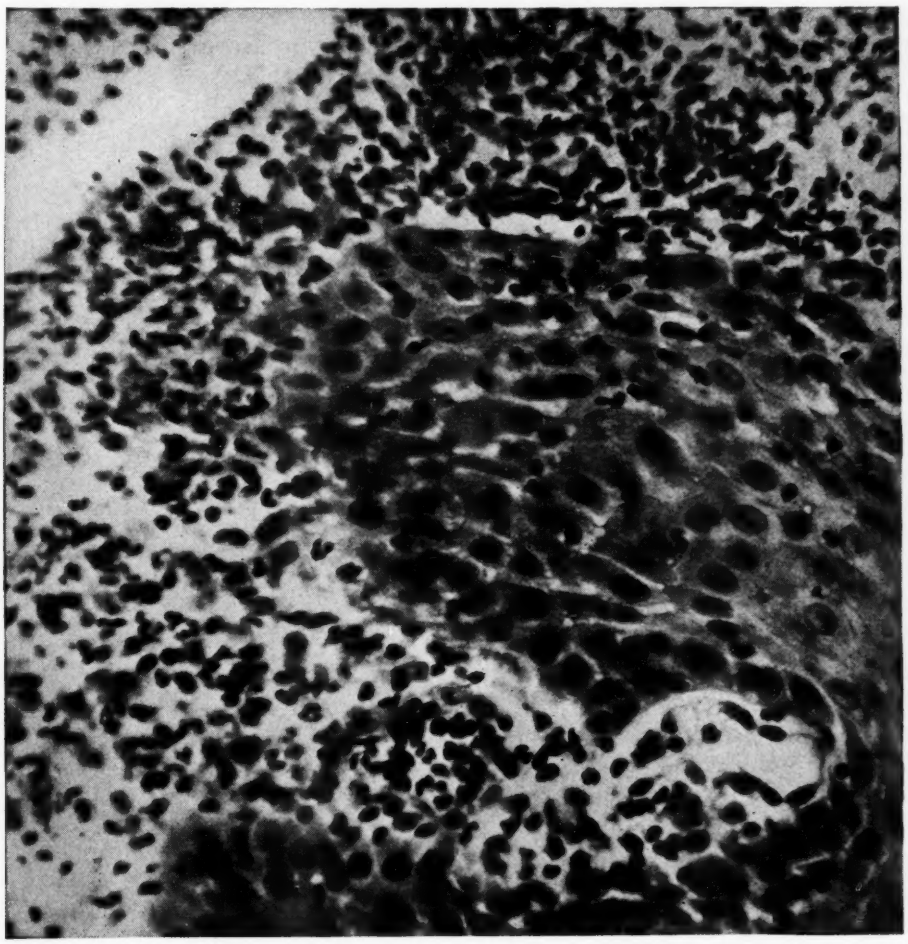

Fig. 29.—Pathol. No. 32217. Atypical growth of epithelium of changed morphology into the granulation tissue of the ulcer shown in Fig. 27. Excised in 1922. No recurrence in 1928.

of soda or a hot saline solution is just as good. The thing to do first is to find the cause of the ulceration and remove it. Whether the cause is found or not, if the ulcer does not heal, it should be removed with a good margin, just as has been advised for fibroma or wart. If the ulcer is too large for complete excision, there should be a biopsy at once; and if the section shows cancer, irradiation should be begun at once. Do not allow a Wassermann plus to delay the excision or the biopsy, unless there are immediate signs of healing after intravenous therapy. Painful tuberculous ulcers too large for complete excision are undoubtedly helped by cauterization.

I wish to repeat that the treatment of ulcers of the oral cavity with caustics or too strong antiseptics, without first removing the causes, if possible, or without diagnosis by excision or biopsy, has great elements of danger.

The dental profession knows much more about the single and multiple superficial ulcerations of the gums at the margin of the teeth than I do. But even in these cases there is no difficulty in getting a piece for diagnosis if there is suspicion, and apparently the best treatment is complete excision of this involved area of the gum. Cancer rarely begins in the gum the seat of pyorrhea only. It begins in leucoplakia of the gum, whether there is pyorrhea or not. Cancer does not seem to be a complication of Riggs' disease.

(To be continued)

ABSTRACTS OF
CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

The Clinical Significance of Vitamin D in Infancy and Childhood. Frederic W. Schlutz. J. A. M. A. **99**: 5, 1932.

In a special article "The Clinical Significance of Vitamin D in Infancy and Childhood" written as one of a series of articles which is being published on the Present Status of the Knowledge of Vitamins in the *Journal of the American Medical Association* under the joint auspices of the Council on Pharmacy and Chemistry and the Committee on Foods (American Medical Association) Schlutz has succeeded in presenting this important and difficult topic in a manner worthy of high praise.

In this instructive article the author mentions the early work of Mellanby in England on experimental rickets and cod liver oil. It was left to McCollum and his co-workers, however, to be the first to differentiate and identify this important vitamin. Later the able investigations of McCollum, Sherman, Hess and also many others showed that vitamin D was not alone a specific in the cure and prevention of rickets, but also a potent factor in the metabolism of calcium and phosphorus. Further investigations by McCollum, Park, Hess, Steenbock and Blunt showed that the ultraviolet portion of the solar spectrum produces all the effects of vitamin D in the animal organism by activating certain substances so that these too possess the properties of vitamin D.

All experimental evidence thus far points to the specific influence of vitamin D on calcium and phosphorus metabolism of the animal organism. In some manner as yet unexplained vitamin D exerts a regulatory function over these elements and tends to correct abnormal relationships and change unfavorable negative balances to the positive or favorable side. Although rickets is the outstanding example which illustrates this phenomenon. There are, however, many disorders which fall within the therapeutic sphere of vitamin D because there is involved a faulty balance of the elements calcium and phosphorus, or because these elements are not properly utilized.

Schlutz points out that the favorable effect of vitamin D on tooth structure and its action in some measure as a preventive of dental caries is definitely proved by the research of May Mellanby, P. R. Howe, Boyd and Drain, and others. As a matter of fact practically all types of antirachitic treatment have a favorable effect on the teeth. These authorities found that not only was the tooth structure improved and the calcium content of it increased, but the tend-

ency to caries modified as well. In other words there is a definite and direct relationship between the original structure of the tooth and its liability to decay.

The fetus has definite requirements for calcium and phosphorus and these are derived entirely from the maternal organism. In the human fetus the elements are stored from about the fourth month on. The storage, which begins slowly at first becomes more rapid towards the end of pregnancy. About two-thirds of the total amount stored at birth is stored during the last two months of pregnancy.

Schlutz writes that every experimental and clinical evidence points to the importance of vitamin D in the form of solar irradiation on cod liver oil or both, in addition to calcium and phosphorus containing diets for both the maternal organism and the offspring if normal growth and development on the part of the latter is to be looked for and unusual drain on the former is to be avoided.

Continuing this eminent pediatrician states that the kind of food that makes up the child's dietary has considerable influence on the calcium and phosphorus metabolism. Foods and food mixtures vary considerably in the degree and readiness with which they give up calcium and phosphorus to the body. This can be largely overcome by supplying vitamin D in adequate amounts. It is of interest to note that this authority states that if taken in large amounts some of the sugars, such as lactose, elevates calcium retention. Moreover orange juice causes an exceptionally high storage of calcium and phosphorus. The author mentions the work of Sherman and Hawley who, contrary to the popular belief, have shown that the storage of calcium from vegetables is rather low and inadequate for the juvenile organism, but on the other hand is good for the adult.

In his discussion of the distribution of vitamin D the author states that all investigators agree that in the natural state cod liver oil contains it in a high degree. It must be remembered moreover that the liver oil and body oil of certain other species of fish are also highly active in their potency of vitamin D. This is true of the halibut, puffer fish, the goosefish, the shark, the haddock, the herring, the sardine, the salmon and the burbot.

After these fish oils the second most potent source of vitamin D is egg yolk. The potency of the egg yolk varies and is largely dependent on the diet of the hen and the amount of solar or artificial ultraviolet irradiation it receives.

Butter fat contains relatively little of the antirachitic factor D. The quantity of vitamin D in cow's milk and butter varies to some extent with the cows and Hess has recently shown that it can be influenced definitely by feeding irradiated yeast to the cows. Investigators have demonstrated also that there is practically no vitamin D content in human milk, but administration of cod liver oil or irradiation of the mother with sources of ultraviolet rays can confer some vitamin D activity on human milk.

In regard to vegetables it has been found that practically all vegetables, whether in a fresh green state or dried, have no vitamin D content and also have practically no antirachitic potency.

The discovery that certain parts of the solar spectrum have the photodynamic action of activating certain organic substances in the plant and animal kingdom and of giving them vitamin D characteristics is one of the great biologic discoveries of the age. As yet the chemical composition of vitamin D is not known. The activity centers about the unsaponifiable fraction of oils or

other foods, which in fats and oils consists largely of cholesterol and in plants of phytosterol. Cholesterol occurs in the brain, skin and blood and in very small amounts in every cell of the body. There is a third sterol, ergosterol, which is particularly abundant in yeast and ergot and is the most widely distributed of all sterols. This is very similar in composition to cholesterol. Incidentally this irradiated ergosterol which is about 2000 times as potent as cholesterol is a chief source of vitamin D and is now made available in nature through photodynamic activity of the solar spectrum.

Irradiated ergosterol prepared as prescribed by the Wisconsin Alumni Foundation Standard has been accepted by the Council on Pharmacy and Chemistry (A. M. A.) under the name of "viosterol." The term "viosterol" signifies that the irradiated ergosterol was dissolved in oil.

In regard to dosage of irradiated ergosterol preparations (viosterol) the standard now used is the one adopted by the Wisconsin Alumni Foundation and is the one now generally accepted in the United States and "postulates a potency for irradiated ergosterol preparations of 250 D. by which is meant 100 times as potent as a good cod liver oil or 250 times the Wisconsin standard. Two drops of it are equivalent in vitamin D potency to a teaspoonful of cod liver oil."

For an average infant or child the daily prophylactic dose of this viosterol preparation in oil is approximately 10 drops. For the premature and rapidly growing infant it may be much higher. The daily curative dose is from 20 to 30 drops and in severe cases may be considerably in excess of such an amount.

The dosage of viosterol brings up its relationship as compared with cod liver oil. Schlutz mentions the interesting clinical observation of Bakwin, who found that with cod liver oil it took an average of sixteen days before the blood calcium returned to normal level and fourteen days with ultraviolet ray but only seven days with ergosterol.

Excessive dosage of irradiated ergosterol may have a harmful effect and the principal toxic effect is expressed in the blood calcium and the blood phosphorus. This may be increased by 25 or 50 per cent of the normal. The toxic effects of the excessive dosage of vitamin D appears to be in direct proportion to the size of the dose.

Schlutz, in his concluding paragraphs, sounds a timely note of warning in regard to the abuse therapeutically of this very important vitamin. This is particularly true in the use of light as a source of vitamin D. There is considerable evidence, both in the experimental animal and also in the human subject, that light can be harmful if used to excess. All clinical evidence seems to show that excessive use of light in any form can have effects quite the reverse from those anticipated or desired.

In commenting on the tremendous progress which has been made with vitamin D, Schlutz succinctly states that vitamin D is one of the indispensable essentials of the growing animal organism. Continuing he adds that although there is much that is known about this important vitamin there is much that is still mysterious and unknown. But (to quote the closing sentence of this scholarly presentation) "there is every reason to believe that the unfolding of these secrets will reveal additional potencies of vitamin D and will reveal what is now not known about its structure and the mechanism of its production and activity."

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EDITORIAL

Children's Dentistry and the Orthodontist

PREVENTIVE dentistry offers encouragement to those in dentistry who believe that the highest professional service is rendered in preventing disease and not in curing after disease has established itself.

Child conservation and welfare fought a losing battle for many years. A quarter of a century ago, mothers thought they were doing their babies and growing children a real favor when they exposed the baby or the child to whooping cough, mumps, measles, and chickenpox, so that these diseases could be contracted early in life and the ordeal gotten over with. In those days it was not uncommon to find mortality rates varying from 25 to 30 per cent among babies and children, and few indeed were the families that had not buried one or more of their flock before the teen age had been reached.

Now it is considered to be almost criminal to let a baby or child be exposed to an infectious disease of any kind. Even in the submerged districts where poverty rules, mothers are careful to keep their babies and their growing children away from families where there are infectious diseases. Public health nurses, clinics, and welfare agencies have done well the job of selling the idea to people in such districts that they must keep the baby or the child away from other sick babies and sick children, while in more enlightened circles of society, the doctor and the nurse have so imposed these same ideas upon the people that infectious diseases, especially in children and in babies, are becoming almost unknown.

It has been only within recent years that consideration of any kind has been given to the care of the deciduous teeth in children. Let the baby teeth decay and get out of the way as quickly as possible was thought to be safe dental advice. To spend money on keeping teeth in a healthy condition in a child when these teeth would be lost in a few years was considered nothing short of foolish extravagance. Looking back now on such ideas and such advice makes one laugh just as it does when one remembers that it was once considered sound practice to expose the child to infectious diseases of all kinds.

Society owes a debt to the pioneers in children's dentistry. Possibly as much benefit has been brought to child life by dentists and doctors who have spread the gospel of preventive dentistry and proper care of deciduous teeth as has come to it through almost any other advice in child welfare work.

Dentists of this day and generation not alive to the necessity of spreading the gospel of preventive dentistry in children and proper care of the deciduous teeth are not subscribing to the highest tenets of their profession. They are equally guilty with the doctor who does not warn the mother that she is derelict in discharging the duties of motherhood when she does not protect her baby against infectious diseases. Children's dentistry means more than merely recommending the practice of oral hygiene measures. It means giving the deciduous teeth the same care that is given the permanent teeth. It means spreading the gospel day after day to mothers and expectant mothers that the teeth of the child should be given the same thoughtful care that is given to the mother or the father, the adult son or adult daughter.

Dentists are prone to dodge the issue in this field of dentistry, because it is much more difficult to do dental work for the growing child than it is for older patients, but these difficulties can and should be overcome. Tact, patience, skill, and the application of common sense will win in this field just as it wins in other fields of dental and medical practice.

Furthermore, a dentist worthy of the name will never dodge responsibilities. He welcomes them and glories in conquering them. Orthodontists see every day the ravages that neglect of deciduous teeth have caused. Possibly they, more than any others who treat the mouth and teeth, are familiar with the dire results that so often follow neglect of a diseased deciduous tooth or teeth. It behooves every one of us to consistently carry on in spreading the gospel of preventive dentistry, children's dentistry and in doing this hasten the day when a baby's tooth will be looked upon as something to be carefully watched by the parents and the dentist. *H. C. P.*

CORRESPONDENCE

Precious Metals Used in Dentistry Exempt From Tax

Section 605 of the 1932 Revenue Bill is known as the Jewelry Section, which includes precious metals, with an excise tax of 10 per cent on all items with a few exceptions.

The undersigned did not construe the phraseology of this bill as justifying its application to precious metals used in dentistry, but from various reports it was apparent that the Bureau of Internal Revenue was planning to do this. Therefore, a letter was addressed to the bureau setting forth logical reasons why this tax should not apply to precious metals used in the practice of dentistry and requesting a ruling in order to incorporate it in a committee report to the American Dental Association. The reply indicated that the question was receiving serious consideration, and this, together with definite information received from other sources, prompted the writing of a strong letter of protest, under date of July 7, setting forth ten specific reasons why this tax should not apply to dentistry. The bureau rendered an opinion, July 16, as per the following telegram:

> REFERENCE TELEGRAM JULY FIFTEENTH PRECIOUS METALS USED IN DENTAL WORK NOT TAXABLE UNDER SECTION SIX HUNDRED FIVE REVENUE ACT NINETEEN THIRTY TWO.

Had this been an adverse ruling it would have resulted in a decided handicap to both the profession and the public. Every dentist can easily determine his saving as being at least 10 per cent on the precious metals used, plus such added expense and time as would be required in keeping records, making monthly reports, etc.

It is recognized that the manufacturers of precious metals, through the American Dental Trade Association, as well as others, were keenly interested and cooperated in obtaining this ruling; therefore, in behalf of every member of the American Dental Association we desire to express grateful appreciation.

Respectfully submitted,

HOMER C. BROWN, Chairman, Committee on Dental Legislation, American Dental Association.

June 21, 1932.

Honorable R. M. Estes, Deputy Commissioner.
Miscellaneous Tax Unit,
Bureau of Internal Revenue,
Treasury Department,
Washington, D. C.

My dear Mr. Estes:

The question as to whether Section 605 of the Revenue Act of 1932 applies in any way to the practice of dentistry has been submitted to me, as chairman

of the Committee on Dental Legislation of the American Dental Association, for my reaction.

After a careful study of Section 604, as it passed the House, it seemed wholly unreasonable to assume that there could be a tax imposed on any phase of dental practice, wherein precious metals were used. A supplemental study of Section 605, as finally passed, convinces me there is no reason for changing my original views; and, further, the administration of such a tax would be next to impossible. However, inasmuch as this question has been presented, together with the fact that I am preparing data to submit in an early report on various legislative problems for our Committee, I shall greatly appreciate an official ruling in order that we may have something authoritative to present.

In this connection, may I not respectfully call your attention to the fact that the practice of dentistry is a well-recognized health service, and while precious metals are liberally used in various dental restorations, yet there is no logic in classifying dental service, or any other phase of health promotion, as a luxury. On the other hand, the public should be encouraged in every possible way to establish and maintain the highest standards of health in order to develop a stronger, happier and more prosperous citizenship, with an increased percentage of producing units.

In behalf of the 36,000 members of the American Dental Association, I thank you in advance for a prompt reply.

Very sincerely yours,

HOMER C. BROWN, Chairman, Committee on Dental Legislation, American Dental Association.

July 7, 1932.

Honorable R. M. Estes, Deputy Commissioner,
Miscellaneous Tax Unit,
Bureau of Internal Revenue,
Treasury Department,
Washington, D. C.

My dear Mr. Estes:

Your letter of July 5 in reply to mine of June 21, relative to the application of the Excise Tax on precious metals of Section 605 of the Revenue Act, has been received. I exceedingly regret that it has not been possible to rule promptly that the use of precious metals in the practice of dentistry is exempted. In view of this, I assume the question is still under consideration, and therefore I herewith supplement my former letter with the following specific reasons against the application of this tax:

(1) The practice of dentistry is *basically and essentially a health service* and in no sense should it be classified as a *luxury*.

(2) The United States Public Health Service recognizes dental service as an important phase of any constructive health program.

(3) The White House Conference on Child Health and Protection lists dental care as the right of every child in Item V of the "Children's Charter."

(4) To establish and maintain higher health standards should be encouraged rather than to penalize those who are desirous of reestablishing dental physiologic function, wherein precious metals are necessary.

(5) Section 605 exempts surgical instruments and frames for glasses, thus clearly indicating that Congress did not contemplate placing any additional burden on surgical operations or the correction of eye defects; both surgery and the corrections of defects, including orthodontic treatment, are involved in most of the dental operations wherein precious metals are used. Also, all "sales tax" legislation introduced at this Session of Congress exempted "medicines," thus recognizing a principle of not taxing the promotion and conservation of health.

(6) The federal government recognizes that dental service is an important factor in health by specifying definite dental requirements of applicants entering West Point and Annapolis, as well as applicants in the various branches of service, such as the army, navy, public health and veteran's bureau, etc.

(7) Any nation seriously blunders that in any way handicaps the development of the health of its citizens to the fullest extent, and it is indeed a serious reflection that a large percentage of draftees, during the World War, were rejected because of dental defects. Also, our material wealth has greatly depreciated during the past three years, some of it to near the vanishing point, and the morale of our people is "shell shocked." All of this tends to lower the physical resistance of many of our citizens and will have a detrimental effect on the race for many years to come.

(8) The administration of such a regulation is practically impossible, and the necessary overhead in connection with record keeping, reporting, etc., will greatly increase the original tax, all of which will be passed on to the public at a time when they can ill afford to assume added burdens. Therefore, it is clearly evident that it is illogical, unreasonable and destructive to the best interests of our country to think of placing an excise tax on precious metals used in promoting health.

(9) Finally, I desire to emphasize that a healthy and contented citizenship is our nation's greatest asset.

(10) If the foregoing, together with the data submitted in my letter of June 21, does not convince you and your associates that the excise tax on precious metals should not apply to dentistry, I respectfully request that a hearing be granted representatives of the American Dental Association, the American Dental Trade Association and the public health interest in order to protest further against such a tax, and may I not add that personally I feel justified in advising that such a tax will be resisted to the court of last resort.

In behalf of the American Dental Association I assure you that a prompt decision and reply will be greatly appreciated, for which I thank you in advance.

Very sincerely yours,

HOMER C. BROWN, Chairman, Committee on Dental Legislation, American Dental Association.

NEWS AND NOTES

Southern Society of Orthodontists Twelfth Annual Meeting

Knoxville Welcomes the Orthodontists

Many serious minded and thinking practitioners of orthodontia are casting an eye on the Southern Society of Orthodontists meeting, which will be held in Knoxville, October 31, November 1 and 2. The Southern Society of Orthodontists has always taken pride in the fact that it is one in which free expressions and discussions of the problems of the orthodontist are the main factor of its meetings.

The Andrew Johnson Hotel will be the headquarters for the meeting.

The preliminary program follows:

Andrew Johnson Hotel which will be the headquarters for the meeting.

"Roentgenographic Measurement of the Developmental and Orthodontic Changes in the Faces of Growing Children," B. Holly Broadbent, Cleveland, Ohio, Director of the Bolton Study, Anatomical Laboratory, Western Reserve University.

"Thoughts on Reading Etiology by Brash," W. W. Woodbury, Halifax, Nova Scotia.

"Growth of the Face and Occlusion of the Teeth in Relation to Orthodontic Treatment," Milo Hellman, New York City.

"Preliminary Studies of Skulls and Teeth of Dogs," A. LeRoy Johnson, New York City.

The title of Dr. Hugh K. Hatfield's paper is not available at this time but will be announced later.

To balance this array of splendid papers and to show that the meeting is not wholly devoted to theory, a fine list of clinics has been arranged. All the clinics cannot be announced at this time; the following have been accepted:

"Fracture Splint for Simple or Multiple Fractures of the Mandible or Maxilla, Practical and of Easy Construction by the Orthodontist," Harry E. Kelsey, Baltimore, Md.

"Space Retainers," Gerard A. Devlin, Newark, N. J.

"Impacted Mandibular Canine," A. S. Bumgardner, Charlotte, N. C.

"Mouth-Breathing Cases Treated With the Pollock Appliance," Harry G. Jones, Indianapolis, Ind.

"Labial and Lingual Arches, Using Coil Springs," V. A. Stilley, Jr., Paducah, Ky.

"Treatment of Deep Overbite With Case Gold Biteplane," Harry C. Metz, Pittsburgh, Pa.

"An Economical Ribbon Arch," Roy D. Mitchell, Atlanta, Ga.

"Space Retainers," Frederick W. Black, Cincinnati, Ohio.

"Some Uses of the Auxillary Spring," E. W. Patton, Birmingham, Ala.

"Willett Cast Overlay Technic," Harvey G. Bean, Toronto, Canada.

"The Balanced Reciprocal Arch," Norris C. Leonard, Baltimore, Md.

"Some Uses of Coil Springs," W. K. Slater, Knoxville, Tenn.

"A Combination Treatment and Retaining Appliance," H. C. Shotwell, Lynchburg, Va.

"Taking Impression to Change Lingual Appliance Without Removing Bands," Winston P. Caine, Chattanooga, Tenn.

"The Possibilities of Correcting Malocclusion Where Loss of Opposing Teeth Has Resulted in Elongation," W. E. Lundy, Memphis, Tenn.

"The Guide-Plane," Oren A. Oliver, Nashville, Tenn.

"Method of Preserving Anchorage Position While Readjusting Lingual Arch," C. F. Bowles, Richmond, Va.

"A Simple Bite-Plane," N. F. Muir, Roanoke, Va.

"A New Scientific Lingual Tube and Shafting," Russell E. Irish, Pittsburgh, Pa.

"Treatment of Cases, a Consideration of the Selection of Appliances Depending Upon the Factors Involved," Andrew F. Jackson, Philadelphia, Pa.

"A Model Trimmer," Ernest N. Bach, Toledo, Ohio.

CLAUDE R. WOOD, President,
Medical Arts Building,
Knoxville, Tenn.
GEORGE M. ANDERSON, Sec'y-Treas.,
831 Park Avenue,
Baltimore, Md.

The Smoky Mountains

One of the features of the meeting will be that on Tuesday afternoon, November 1, all those attending the meeting will enjoy a trip in the Great Smoky Mountains, with a barbecue that evening. This area is one of the newly acquired national parks.

Great Smoky Mountains National Park is on the Tennessee-North Carolina line. On the Tennessee side it is twenty miles from Knoxville, and on the North Carolina side it is within fifty miles of Asheville.

This comparatively new national park comprises 427,000 acres of land in the Great Smoky Mountains of the Appalachians. Roughly, the park area is sixty-five miles long, and from fifteen to twenty-five miles wide. Here the Appalachian range bulks out to its greatest width and rises to its greatest height. The main ridge is rarely less than one mile high, and a number of peaks rise above that height, Clingman's Dome being 6,642 feet.

Thousands of acres are virgin forests, and here are many varieties of wild flowers, plants, shrubs and trees. Bear, deer, and other wild game, and wild fowls, which are found in the Smokies, will be protected. However, this game will overflow to the surrounding territory, including the adjoining National Forests, in which hunting is allowed.

There are more than six hundred miles of streams in the park, and there are hundreds more in the National Forests. Many of these streams are now excellent for fishing, and hundreds of miles more are being stocked. Fishing licenses may be secured under the state regulations.

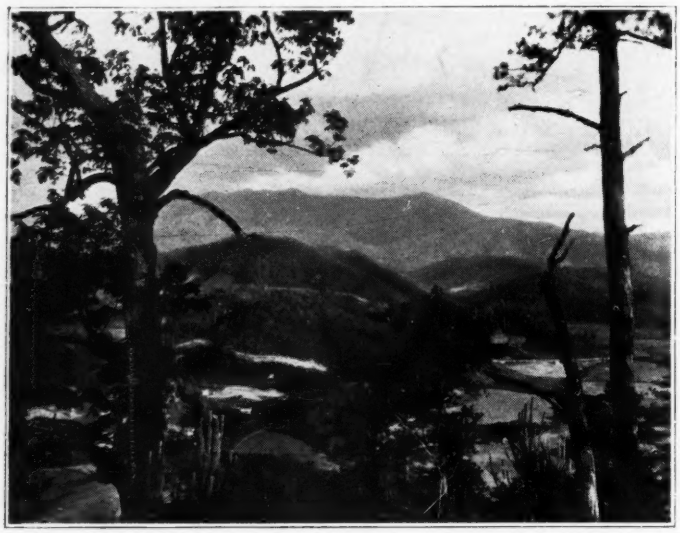
Sunrise above the clouds.

A glimpse of the chimneys in the Great Smoky Mountain National Park.

The Great Smoky Mountains are rough and rugged, and tourists may enjoy their virgin grandeur the year round because this is an all-year park.

Both Tennessee and North Carolina have built splendid roads throughout the park. There are fine hiking trails and some of them are ideal for horseback riding.

Visitors to the park should understand that the National Park Service has not developed this park; so far all the roads have been built by the States. The last Congress, however, appropriated $500,000 for building roads and trails. The government has not built any hotels or cabins in the Park, nor has it established any camping grounds. However, in the park and in the adjoining low ranges there are hotels (many of them open only in the summer). Within ten or fifteen miles of the park on the Tennessee side there are small towns with comfortable all-year hotels, and there are large towns and cities with modern hotels. Knoxville, a city of 149,000, is only twenty miles from the park boundary. On the North



Mt. Le Conte in the Great Smoky Mountains near Knoxville rises to an elevation of 6,680 feet above sea level. On its slopes and in its coves are to be found a greater variety of trees, flowering shrubs and wild flowers than can be found in any other area of equal size in the world.

Carolina side are small towns with comfortable hotels almost on the park boundary, and Asheville with all its modern hotels is only fifty miles away.

On top of Mt. Le Conte is an all-night lodge, but arrangements should be made in advance before hiking up it.

Hikers and fishermen can secure guides at Gatlinburg, just on the park border line. This is a popular point to start hiking, especially to Le Conte or Elkmount in the park.

From Bryson City a good road leads to the 51,000-acre Qualla Indian Reservation, with its 3,000 full-blooded Cherokee Indians. The reservations is "within" but not in the park. It could not, of course, be included, but it is surrounded on three sides by the park.

American Society of Orthodontists

The thirty-second annual meeting of the American Society of Orthodontists will be held in Oklahoma City, Oklahoma, April 19, 20 and 21, 1933.

A cordial invitation is extended to all ethical practitioners of dentistry and orthodontia to attend this meeting.

WM. E. FLESHER, President,
Medical Arts Bldg.,
Oklahoma City, Okla.

CLAUDE R. WOOD, Secretary-Treasurer,
Medical Arts Bldg.,
Knoxville, Tenn.

The New York Society of Orthodontists

The fall meeting of the New York Society of Orthodontists will be held at the Hotel Waldorf Astoria, Park Avenue, New York City, on Monday and Tuesday, November 14 and 15. The opening session will begin on Monday at 9:30 A.M. An exceptionally valuable program has been arranged. All interested physicians and dentists are cordially invited.

FRANKLIN A. SQUIRES, Secretary,
Medical Centre Bldg.,
170 Maple Avenue,
White Plains, N. Y.

The American Society for the Advancement of General Anesthesia in Dentistry

The scientific program for the season of 1932-1933 of the American Society for the Advancement of General Anesthesia in Dentistry will commence on Monday evening, October 24, at the New York Physicians Club, 133 E. 58th Street (corner of Lexington Avenue), New York City.

The meeting will open with a dinner at 7 P.M., and the scientific session at 8:15 P.M. Dr. James R. Cameron of Philadelphia, Pa., will read a paper entitled "The Control of Emergencies arising during General Anesthesia." Discussion will be opened by Dr. Robert A. Robinson of Albany, N. Y.

Membership in this organization is available to members of the American Dental Association and American Medical Association, and registered nurses or scientists interested in the field of anesthesia.

Officers for the ensuing year are:

JAMES TAYLOE GWATHMEY, M.D., Honorary President,
133 E. 58th Street,
New York City.
M. HILLEL FELDMAN, D.D.S., President,
730 Fifth Avenue,
New York City.
LEONARD S. MORVAY, D.D.S., Secretary and Treasurer,
76 Clinton Ave.,
Newark, N. J.

Greater New York December Meeting

The eighth annual Greater New York December Meeting will be held at the Hotel Pennsylvania, New York City, December 5-9, 1932.

This meeting is held under the auspices of the First and Second District Dental Societies.

The program is being developed with the idea of devoting more than the usual amount of attention to the things that count for efficiency in the everyday practice of our profession.

CARROLL B. WHITCOMB, Chairman.

Sixty-Seventh Annual Meeting of Ohio State Dental Society

The Ohio State Dental Society will hold its 1932 meeting in Cleveland on December 5, 6, and 7. Arrangements are being made for a program by outstanding men in the various specialties of dentistry. The program will be divided into the four sections of dentistry, and the four sections will be in session at one time, thus insuring a maximum diversity of choice in the type of program.

EDWARD C. MILLS, Secretary,
255 East Broad Street,
Columbus, Ohio.

The Society of Plastic and Reconstructive Surgery

The Society of Plastic and Reconstructive Surgery held its first scientific meeting June 3, at the New York Academy of Medicine, New York City. The first annual meeting of the society will be held on October 28 and 29, 1932, at the New York Academy of Medicine.

GASTON LABAT, General Secretary,
30 E. 40th Street,
New York City, N. Y.